ORIGINS LABORATORY, INC

July 26, 2016

Pinyon

Corinne Wardell

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

Project Name - CCOD Federal **Project Number - 11600702.2102**

Attached are your analytical results for CCOD Federal received by Origins Laboratory, Inc. March 04, 2016. This project is associated with Origins project number X603072-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RW6SS01 (30-35')	X603072-01	Soil	March 1, 2016 14:45	03/04/2016 15:48
RW6SS02 (15-20')	X603072-02	Soil	March 1, 2016 12:25	03/04/2016 15:48
PE8SS01 (0-5')	X603072-03	Soil	March 1, 2016 15:51	03/04/2016 15:48
RW9SS01 (10-15')	X603072-04	Soil	March 4, 2016 14:24	03/04/2016 15:48
RW19SS01 (5-10')	X603072-05	Soil	March 2, 2016 10:03	03/04/2016 15:48
RW23SS01 (5-10')	X603072-06	Soil	March 4, 2016 12:13	03/04/2016 15:48
RW25SS01 (50-55')	X603072-07	Soil	March 2, 2016 16:24	03/04/2016 15:48
RW28SS01 (0-5')	X603072-08	Soil	March 3, 2016 14:12	03/04/2016 15:48
RW32SS01 (10-15')	X603072-09	Soil	March 2, 2016 12:22	03/04/2016 15:48

Per the email from Corrine on 07/15/16, TCLP lead was added to samples RW9SS01(10-15') and RW28SS01 (0-5).

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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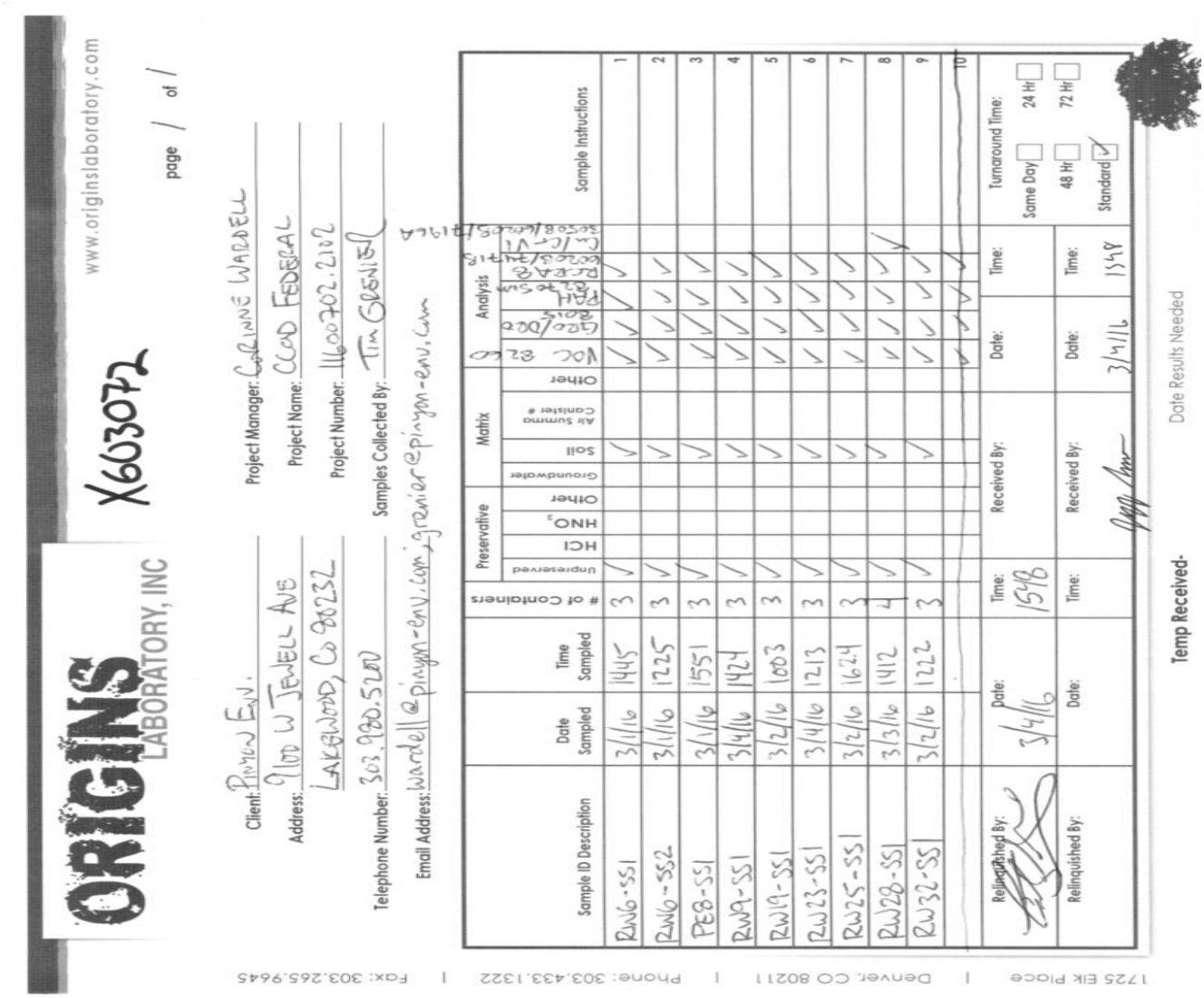

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: X603072

Client: Pinyon

Client Project ID: CCOD Federal

Checklist Completed by: Jeff Smith

Shipped Via: HTD (UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 3/4/16

Airbill #: NA

Matrix(s) Received: (Check all that apply): X Soil/Solid _____ Water _____ Other: _____

Cooler Number/Temperature: _____/5.7 °C _____/_____ °C _____/_____ °C _____/_____ °C (Describe)

Thermometer ID: T003

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]?	X			
Is there ice present (document if blue ice is used)	A			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		-		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		A		
Were all samples received intact[1]?	X			
Was adequate sample volume provided[1]?	X			
Are short holding time analytes or samples with HTs due within 48 hours present[1]?		X		
Is a chain-of-custody (COC) present and filled out completely[1]?	X			
Does the COC agree with the number and type of sample bottles received[1]?	A			
Do the sample IDs on the bottle labels match the COC[1]?	A			
Is the COC properly relinquished by the client with date and time recorded[1]?	X			
For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.**			X	
Are samples preserved that require preservation and was it checked [1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / (pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)*			X	
Additional Comments (if any):				

[1] *If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) — Date/Time Reviewed: 3/7/16

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW6SS01 (30-35')
3/1/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-01 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*95.9 %*		*59-131*			"	"	"	
PAH by 8270D SIM									
Acenaphthene	ND	0.00213	0.00853	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Acenaphthylene	ND	0.00213	0.00853	"	"	"	"	"	U
Anthracene	ND	0.00213	0.00853	"	"	"	"	"	U
Benzo(a)anthracene	ND	0.00213	0.00853	"	"	"	"	"	U
Benzo(a)pyrene	ND	0.00213	0.00853	"	"	"	"	"	U
Benzo(b)fluoranthene	ND	0.00213	0.00853	"	"	"	"	"	U
Benzo(ghi)perylene	ND	0.00213	0.00853	"	"	"	"	"	U
Benzo(k)fluoranthene	ND	0.00213	0.00853	"	"	"	"	"	U
Chrysene	ND	0.00213	0.00853	"	"	"	"	"	U
Dibenzo(a,h)anthracene	ND	0.00213	0.00853	"	"	"	"	"	U
Fluoranthene	ND	0.00213	0.00853	"	"	"	"	"	U
Fluorene	ND	0.00213	0.00853	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.00213	0.00853	"	"	"	"	"	U

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Project Number: 11600702.2102
Project: CCOD Federal

RW6SS01 (30-35')
3/1/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-01 (Soil)									
PAH by 8270D SIM									
Naphthalene	ND	0.00128	0.00853	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Phenanthrene	**0.00256**	**0.00213**	0.00853	"	"	"	"	"	BJ
Pyrene	ND	0.00213	0.00853	"	"	"	"	"	U
Surrogate: 5-alpha-Androstane	*72 %*		*25-129*			"	"	"	
Total Metals by 6010C									
Arsenic	ND	0.608	3.65	mg/kg dry	1	1550259	03/07/2016	03/08/2016	U
Barium	**272**	**0.122**	0.608	"	"	"	"	"	
Cadmium	**0.153**	**0.122**	0.608	"	"	"	"	"	J
Chromium	**10.7**	**0.183**	0.608	"	"	"	"	"	
Lead	**10.1**	**0.402**	1.22	"	"	"	"	"	
Selenium	ND	0.608	3.65	"	"	"	"	"	U
Silver	**0.880**	**0.122**	0.608	"	"	"	"	"	
Total Metals by 7471A									
Mercury	**0.0101**	**0.00504**	0.015	mg/kg dry	1	1550213	"	03/08/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua

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RW6SS01 (30-35')
3/1/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-01 (Soil)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua

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RW6SS01 (30-35')
3/1/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-01 (Soil)

VOC by EPA 8260C

2-Butanone	ND	0.0100	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

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RW6SS01 (30-35')
3/1/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-01 (Soil)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

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Project: CCOD Federal

RW6SS01 (30-35')
3/1/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-01 (Soil)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*117 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*93.8 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*107 %*		*70-130*			"	"	"	

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Project: CCOD Federal

RW6SS02 (15-20')
3/1/2016 12:25:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-02 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*69.7 %*		*59-131*			"	"	"	
PAH by 8270D SIM									
Acenaphthene	ND	0.00218	0.00873	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Acenaphthylene	ND	0.00218	0.00873	"	"	"	"	"	U
Anthracene	ND	0.00218	0.00873	"	"	"	"	"	U
Benzo(a)anthracene	ND	0.00218	0.00873	"	"	"	"	"	U
Benzo(a)pyrene	ND	0.00218	0.00873	"	"	"	"	"	U
Benzo(b)fluoranthene	ND	0.00218	0.00873	"	"	"	"	"	U
Benzo(ghi)perylene	ND	0.00218	0.00873	"	"	"	"	"	U
Benzo(k)fluoranthene	ND	0.00218	0.00873	"	"	"	"	"	U
Chrysene	ND	0.00218	0.00873	"	"	"	"	"	U
Dibenzo(a,h)anthracene	ND	0.00218	0.00873	"	"	"	"	"	U
Fluoranthene	ND	0.00218	0.00873	"	"	"	"	"	U
Fluorene	ND	0.00218	0.00873	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.00218	0.00873	"	"	"	"	"	U

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Project: CCOD Federal

RW6SS02 (15-20')
3/1/2016 12:25:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-02 (Soil)									
PAH by 8270D SIM									
Naphthalene	ND	0.00131	0.00873	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Phenanthrene	**0.00262**	**0.00218**	0.00873	"	"	"	"	"	BJ
Pyrene	ND	0.00218	0.00873	"	"	"	"	"	U
Surrogate: 5-alpha-Androstane	*71 %*		*25-129*			"	"	"	
Total Metals by 6010C									
Arsenic	ND	0.646	3.88	mg/kg dry	1	1550259	03/07/2016	03/08/2016	U
Barium	**116**	**0.129**	0.646	"	"	"	"	"	
Cadmium	**0.152**	**0.129**	0.646	"	"	"	"	"	J
Chromium	**9.64**	**0.194**	0.646	"	"	"	"	"	
Lead	**11.7**	**0.426**	1.29	"	"	"	"	"	
Selenium	ND	0.646	3.88	"	"	"	"	"	U
Silver	**1.17**	**0.129**	0.646	"	"	"	"	"	
Total Metals by 7471A									
Mercury	**0.0059**	**0.00501**	0.0149	mg/kg dry	1	1550213	"	03/08/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua

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Project: CCOD Federal

RW6SS02 (15-20')
3/1/2016 12:25:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-02 (Soil)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW6SS02 (15-20')
3/1/2016 12:25:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-02 (Soil)

VOC by EPA 8260C

2-Butanone	ND	0.0100	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	**0.0213**	0.0200	"	"	"	"	"	
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW6SS02 (15-20')
3/1/2016 12:25:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-02 (Soil)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW6SS02 (15-20')
3/1/2016 12:25:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-02 (Soil)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*119 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*92.9 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*107 %*		*70-130*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PE8SS01 (0-5')
3/1/2016 3:51:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-03 (Soil)

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*83.7 %*		*59-131*			"	"	"	

PAH by 8270D SIM

Acenaphthene	**0.0205**	**0.0019**	0.00758	mg/kg dry	1	1550304	03/08/2016	03/10/2016	
Acenaphthylene	**0.0144**	**0.0019**	0.00758	"	"	"	"	"	
Anthracene	**0.0553**	**0.0019**	0.00758	"	"	"	"	"	
Benzo(a)anthracene	**0.162**	**0.0019**	0.00758	"	"	"	"	"	
Benzo(a)pyrene	**0.148**	**0.0019**	0.00758	"	"	"	"	"	
Benzo(b)fluoranthene	**0.180**	**0.0019**	0.00758	"	"	"	"	"	
Benzo(ghi)perylene	**0.0785**	**0.0019**	0.00758	"	"	"	"	"	
Benzo(k)fluoranthene	**0.072**	**0.0019**	0.00758	"	"	"	"	"	
Chrysene	**0.165**	**0.0019**	0.00758	"	"	"	"	"	
Dibenzo(a,h)anthracene	**0.0284**	**0.0019**	0.00758	"	"	"	"	"	
Fluoranthene	**0.267**	**0.0019**	0.00758	"	"	"	"	"	
Fluorene	**0.0258**	**0.0019**	0.00758	"	"	"	"	"	
Indeno(1,2,3-cd)pyrene	**0.0868**	**0.0019**	0.00758	"	"	"	"	"	
Naphthalene	**0.0186**	**0.00114**	0.00758	"	"	"	"	"	
Phenanthrene	**0.212**	**0.0019**	0.00758	"	"	"	"	"	B

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PE8SS01 (0-5')
3/1/2016 3:51:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-03 (Soil)									
PAH by 8270D SIM									
Pyrene	**0.295**	**0.0019**	0.00758	mg/kg dry	1	1550304	03/08/2016	03/10/2016	
Surrogate: 5-alpha-Androstane	*77 %*		*25-129*			"	"	"	
Total Metals by 6010C									
Arsenic	**1.49**	**0.556**	3.34	mg/kg dry	1	1550259	03/07/2016	03/08/2016	J
Barium	**203**	**0.111**	0.556	"	"	"	"	"	
Cadmium	**0.298**	**0.111**	0.556	"	"	"	"	"	J
Chromium	**8.43**	**0.167**	0.556	"	"	"	"	"	
Lead	**43.3**	**0.367**	1.11	"	"	"	"	"	
Selenium	ND	0.556	3.34	"	"	"	"	"	U
Silver	**0.506**	**0.111**	0.556	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.125**	**0.00391**	0.0117	mg/kg dry	1	1550213	"	03/08/2016	
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND		0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PE8SS01 (0-5')
3/1/2016 3:51:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-03 (Soil)

VOC by EPA 8260C

1,1,2-Trichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PE8SS01 (0-5')
3/1/2016 3:51:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-03 (Soil)

VOC by EPA 8260C

2-Hexanone	ND	0.0100	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PE8SS01 (0-5')
3/1/2016 3:51:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-03 (Soil)

VOC by EPA 8260C

Dibromomethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Trichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PE8SS01 (0-5')
3/1/2016 3:51:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-03 (Soil)

VOC by EPA 8260C

Trichlorofluoromethane	ND	0.00300	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*117 %*	*70-130*			"	"	"	
Surrogate: Toluene-d8	*93.1 %*	*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*108 %*	*70-130*			"	"	"	

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW9SS01 (10-15')
3/4/2016 2:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-04 (Soil)

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	**122**		50.0	"	"	"	"	"	
Surrogate: o-Terphenyl	*92.5 %*		*59-131*			"	"	"	

PAH by 8270D SIM

Acenaphthene	ND	0.00914	0.0366	mg/kg dry	5	1550304	03/08/2016	03/10/2016	U
Acenaphthylene	ND	0.00914	0.0366	"	"	"	"	"	U
Anthracene	ND	0.00914	0.0366	"	"	"	"	"	U
Benzo(a)anthracene	**0.102**	**0.00914**	0.0366	"	"	"	"	"	
Benzo(a)pyrene	**0.150**	**0.00914**	0.0366	"	"	"	"	"	
Benzo(b)fluoranthene	**0.234**	**0.00914**	0.0366	"	"	"	"	"	
Benzo(ghi)perylene	**0.124**	**0.00914**	0.0366	"	"	"	"	"	
Benzo(k)fluoranthene	**0.0805**	**0.00914**	0.0366	"	"	"	"	"	
Chrysene	**0.128**	**0.00914**	0.0366	"	"	"	"	"	
Dibenzo(a,h)anthracene	**0.0457**	**0.00914**	0.0366	"	"	"	"	"	
Fluoranthene	**0.106**	**0.00914**	0.0366	"	"	"	"	"	
Fluorene	ND	0.00914	0.0366	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	**0.104**	**0.00914**	0.0366	"	"	"	"	"	
Naphthalene	**0.0146**	**0.00549**	0.0366	"	"	"	"	"	J

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW9SS01 (10-15')
3/4/2016 2:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-04 (Soil)									
PAH by 8270D SIM									
Phenanthrene	**0.0585**	**0.00914**	0.0366	mg/kg dry	5	1550304	03/08/2016	03/10/2016	B
Pyrene	**0.152**	**0.00914**	0.0366	"	"	"	"	"	
Surrogate: 5-alpha-Androstane	*76 %*		*25-129*			"	"	"	
TCLP Metals by 1311/6010C									
Lead	**0.190**	**0.033**	0.100	mg/L	1	1583733	07/21/2016	07/22/2016	
Total Metals by 6010C									
Arsenic	**0.785**	**0.550**	3.30	mg/kg dry	1	1550259	03/07/2016	03/08/2016	J
Barium	**231**	**0.110**	0.550	"	"	"	"	"	
Cadmium	**0.513**	**0.110**	0.550	"	"	"	"	"	J
Chromium	**39.3**	**0.165**	0.550	"	"	"	"	"	
Lead	**147**	**0.363**	1.10	"	"	"	"	"	
Selenium	ND	0.550	3.30	"	"	"	"	"	U
Silver	**2.05**	**0.110**	0.550	"	"	"	"	"	
Total Metals by 7471A									
Mercury	**0.0514**	**0.00411**	0.0123	mg/kg dry	1	1550213	"	03/08/2016	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW9SS01 (10-15')
3/4/2016 2:24:00PM

Origins Laboratory, Inc.

X603072-04 (Soil)

VOC by EPA 8260C

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND		0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND		0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND		0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND		0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND		0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND		0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND		0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND		0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND		0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND		0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW9SS01 (10-15')
3/4/2016 2:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-04 (Soil)

VOC by EPA 8260C

2,2-Dichloropropane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	**0.0230**	0.0200	"	"	"	"	"	
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW9SS01 (10-15')
3/4/2016 2:24:00PM

Origins Laboratory, Inc.

X603072-04 (Soil)

VOC by EPA 8260C

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
cis-1,3-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
Dibromochloromethane	ND		0.00200	"	"	"	"	"	Ua
Dibromomethane	ND		0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND		0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND		0.00500	"	"	"	"	"	Ua
Iodomethane	ND		0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND		0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND		0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND		0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND		0.0200	"	"	"	"	"	Ua
Naphthalene	ND		0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND		0.00200	"	"	"	"	"	Ua
o-Xylene	ND		0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
Styrene	ND		0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND		0.00200	"	"	"	"	"	Ua
Toluene	ND		0.00200	"	"	"	"	"	Ua

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Project: CCOD Federal

RW9SS01 (10-15')
3/4/2016 2:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-04 (Soil)									
VOC by EPA 8260C									
trans-1,2-Dichloroethene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
trans-1,3-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*114 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*96.0 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*113 %*		*70-130*			"	"	"	

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW19SS01 (5-10')
3/2/2016 10:03:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-05 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*65.9 %*		*59-131*			"	"	"	
PAH by 8270D SIM									
Acenaphthene	ND	0.00211	0.00844	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Acenaphthylene	ND	0.00211	0.00844	"	"	"	"	"	U
Anthracene	ND	0.00211	0.00844	"	"	"	"	"	U
Benzo(a)anthracene	ND	0.00211	0.00844	"	"	"	"	"	U
Benzo(a)pyrene	ND	0.00211	0.00844	"	"	"	"	"	U
Benzo(b)fluoranthene	ND	0.00211	0.00844	"	"	"	"	"	U
Benzo(ghi)perylene	ND	0.00211	0.00844	"	"	"	"	"	U
Benzo(k)fluoranthene	ND	0.00211	0.00844	"	"	"	"	"	U
Chrysene	ND	0.00211	0.00844	"	"	"	"	"	U
Dibenzo(a,h)anthracene	ND	0.00211	0.00844	"	"	"	"	"	U
Fluoranthene	ND	0.00211	0.00844	"	"	"	"	"	U
Fluorene	ND	0.00211	0.00844	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.00211	0.00844	"	"	"	"	"	U

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW19SS01 (5-10')
3/2/2016 10:03:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-05 (Soil)									
PAH by 8270D SIM									
Naphthalene	ND	0.00127	0.00844	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Phenanthrene	**0.00253**	**0.00211**	0.00844	"	"	"	"	"	BJ
Pyrene	ND	0.00211	0.00844	"	"	"	"	"	U
Surrogate: 5-alpha-Androstane	*72 %*		*25-129*			"	"	"	
Total Metals by 6010C									
Arsenic	**1.89**	**0.622**	3.73	mg/kg dry	1	1550259	03/07/2016	03/08/2016	J
Barium	**153**	**0.124**	0.622	"	"	"	"	"	
Cadmium	**0.158**	**0.124**	0.622	"	"	"	"	"	J
Chromium	**8.94**	**0.187**	0.622	"	"	"	"	"	
Lead	**12.4**	**0.411**	1.24	"	"	"	"	"	
Selenium	ND	0.622	3.73	"	"	"	"	"	U
Silver	**0.873**	**0.124**	0.622	"	"	"	"	"	
Total Metals by 7471A									
Mercury	**0.0105**	**0.00474**	0.0142	mg/kg dry	1	1550213	"	03/08/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW19SS01 (5-10')
3/2/2016 10:03:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-05 (Soil)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW19SS01 (5-10')
3/2/2016 10:03:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-05 (Soil)

VOC by EPA 8260C

2-Butanone	ND	0.0100	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

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Project: CCOD Federal

RW19SS01 (5-10')
3/2/2016 10:03:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-05 (Soil)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

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Project: CCOD Federal

RW19SS01 (5-10')
3/2/2016 10:03:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-05 (Soil)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*119 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*91.9 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*105 %*		*70-130*			"	"	"	

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW23SS01 (5-10')
3/4/2016 12:13:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-06 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*77.4 %*		*59-131*			"	"	"	
PAH by 8270D SIM									
Acenaphthene	ND	0.00195	0.00779	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Acenaphthylene	ND	0.00195	0.00779	"	"	"	"	"	U
Anthracene	ND	0.00195	0.00779	"	"	"	"	"	U
Benzo(a)anthracene	ND	0.00195	0.00779	"	"	"	"	"	U
Benzo(a)pyrene	ND	0.00195	0.00779	"	"	"	"	"	U
Benzo(b)fluoranthene	ND	0.00195	0.00779	"	"	"	"	"	U
Benzo(ghi)perylene	ND	0.00195	0.00779	"	"	"	"	"	U
Benzo(k)fluoranthene	ND	0.00195	0.00779	"	"	"	"	"	U
Chrysene	ND	0.00195	0.00779	"	"	"	"	"	U
Dibenzo(a,h)anthracene	ND	0.00195	0.00779	"	"	"	"	"	U
Fluoranthene	ND	0.00195	0.00779	"	"	"	"	"	U
Fluorene	ND	0.00195	0.00779	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.00195	0.00779	"	"	"	"	"	U

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW23SS01 (5-10')
3/4/2016 12:13:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-06 (Soil)									
PAH by 8270D SIM									
Naphthalene	ND	0.00117	0.00779	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Phenanthrene	**0.00234**	**0.00195**	0.00779	"	"	"	"	"	BJ
Pyrene	ND	0.00195	0.00779	"	"	"	"	"	U
Surrogate: 5-alpha-Androstane	*67 %*		*25-129*			"	"	"	
Total Metals by 6010C									
Arsenic	**0.699**	**0.571**	3.43	mg/kg dry	1	1550259	03/07/2016	03/08/2016	J
Barium	**107**	**0.114**	0.571	"	"	"	"	"	
Cadmium	**0.130**	**0.114**	0.571	"	"	"	"	"	J
Chromium	**11.2**	**0.171**	0.571	"	"	"	"	"	
Lead	**11.2**	**0.377**	1.14	"	"	"	"	"	
Selenium	ND	0.571	3.43	"	"	"	"	"	U
Silver	**0.730**	**0.114**	0.571	"	"	"	"	"	
Total Metals by 7471A									
Mercury	**0.00685**	**0.00468**	0.014	mg/kg dry	1	1550213	"	03/08/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW23SS01 (5-10')
3/4/2016 12:13:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-06 (Soil)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW23SS01 (5-10')
3/4/2016 12:13:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-06 (Soil)

VOC by EPA 8260C

2-Butanone	ND	0.0100	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW23SS01 (5-10')
3/4/2016 12:13:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-06 (Soil)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW23SS01 (5-10')
3/4/2016 12:13:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-06 (Soil)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*124 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*91.9 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*108 %*		*70-130*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW25SS01 (50-55')
3/2/2016 4:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-07 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*94.5 %*		*59-131*			"	"	"	
PAH by 8270D SIM									
Acenaphthene	ND	0.00225	0.00901	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Acenaphthylene	ND	0.00225	0.00901	"	"	"	"	"	U
Anthracene	ND	0.00225	0.00901	"	"	"	"	"	U
Benzo(a)anthracene	ND	0.00225	0.00901	"	"	"	"	"	U
Benzo(a)pyrene	**0.0473**	**0.00225**	0.00901	"	"	"	"	"	
Benzo(b)fluoranthene	ND	0.00225	0.00901	"	"	"	"	"	U
Benzo(ghi)perylene	ND	0.00225	0.00901	"	"	"	"	"	U
Benzo(k)fluoranthene	ND	0.00225	0.00901	"	"	"	"	"	U
Chrysene	ND	0.00225	0.00901	"	"	"	"	"	U
Dibenzo(a,h)anthracene	ND	0.00225	0.00901	"	"	"	"	"	U
Fluoranthene	ND	0.00225	0.00901	"	"	"	"	"	U
Fluorene	ND	0.00225	0.00901	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.00225	0.00901	"	"	"	"	"	U

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW25SS01 (50-55')
3/2/2016 4:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-07 (Soil)									
PAH by 8270D SIM									
Naphthalene	ND	0.00135	0.00901	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Phenanthrene	**0.0027**	**0.00225**	0.00901	"	"	"	"	"	BJ
Pyrene	ND	0.00225	0.00901	"	"	"	"	"	U
Surrogate: 5-alpha-Androstane	*75 %*		*25-129*			"	"	"	
Total Metals by 6010C									
Arsenic	**2.06**	**0.650**	3.90	mg/kg dry	1	1550259	03/07/2016	03/08/2016	J
Barium	**157**	**0.130**	0.650	"	"	"	"	"	
Cadmium	**0.149**	**0.130**	0.650	"	"	"	"	"	J
Chromium	**11.7**	**0.195**	0.650	"	"	"	"	"	
Lead	**13.9**	**0.429**	1.30	"	"	"	"	"	
Selenium	ND	0.650	3.90	"	"	"	"	"	U
Silver	**0.883**	**0.130**	0.650	"	"	"	"	"	
Total Metals by 7471A									
Mercury	**0.011**	**0.0046**	0.0137	mg/kg dry	1	1550213	"	03/08/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW25SS01 (50-55')
3/2/2016 4:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-07 (Soil)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW25SS01 (50-55')
3/2/2016 4:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-07 (Soil)

VOC by EPA 8260C

2-Butanone	ND	0.0100	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	**0.0430**	0.0200	"	"	"	"	"	
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW25SS01 (50-55')
3/2/2016 4:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-07 (Soil)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW25SS01 (50-55')
3/2/2016 4:24:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-07 (Soil)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*116 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*93.3 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*107 %*		*70-130*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW28SS01 (0-5')
3/3/2016 2:12:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-08 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/10/2016	Ua
Diesel (C10-C28)	**902**		50.0	"	"	"	"	"	
Surrogate: o-Terphenyl	*77.3 %*		*59-131*			"	"	"	
PAH by 8270D SIM									
Acenaphthene	**0.0561**	**0.0108**	0.0431	mg/kg dry	5	1550304	03/08/2016	03/09/2016	
Acenaphthylene	**0.0431**	**0.0108**	0.0431	"	"	"	"	"	
Anthracene	**0.211**	**0.0108**	0.0431	"	"	"	"	"	
Benzo(a)anthracene	**0.837**	**0.0108**	0.0431	"	"	"	"	"	
Benzo(a)pyrene	**0.947**	**0.0108**	0.0431	"	"	"	"	"	
Benzo(b)fluoranthene	**1.32**	**0.0108**	0.0431	"	"	"	"	"	
Benzo(ghi)perylene	**0.658**	**0.0108**	0.0431	"	"	"	"	"	
Benzo(k)fluoranthene	**0.539**	**0.0108**	0.0431	"	"	"	"	"	
Chrysene	**1.03**	**0.0108**	0.0431	"	"	"	"	"	
Dibenzo(a,h)anthracene	**0.211**	**0.0108**	0.0431	"	"	"	"	"	
Fluoranthene	**1.14**	**0.0108**	0.0431	"	"	"	"	"	
Fluorene	**0.0388**	**0.0108**	0.0431	"	"	"	"	"	J
Indeno(1,2,3-cd)pyrene	**0.632**	**0.0108**	0.0431	"	"	"	"	"	
Naphthalene	**0.082**	**0.00647**	0.0431	"	"	"	"	"	
Phenanthrene	**0.884**	**0.0108**	0.0431	"	"	"	"	"	B

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW28SS01 (0-5')
3/3/2016 2:12:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

GEL Laboratories, LLC

X603072-08 (Soil)

PAH by 8270D SIM

Pyrene	**2.08**	**0.0108**	0.0431	mg/kg dry	5	1550304	03/08/2016	03/09/2016	
Surrogate: 5-alpha-Androstane	*63 %*		*25-129*			"	"	"	

TCLP Metals by 1311/6010C

Lead	**0.292**	**0.033**	0.100	mg/L	1	1584783	07/26/2016	07/26/2016	

Total Metals by 6010C

Arsenic	**5.01**	**0.644**	3.86	mg/kg dry	1	1550259	03/07/2016	03/08/2016	
Barium	**972**	**0.129**	0.644	"	"	"	"	"	
Cadmium	**1.25**	**0.129**	0.644	"	"	"	"	"	
Chromium	**30.0**	**0.193**	0.644	"	"	"	"	"	
Lead	**580**	**0.425**	1.29	"	"	"	"	"	
Selenium	**1.22**	**0.644**	3.86	"	"	"	"	"	J
Silver	**1.84**	**0.129**	0.644	"	"	"	"	"	

Total Metals by 6020A

Copper	**165**	**.085**	.258	mg/kg dry	2	1550257	03/08/2016	03/08/2016	

Total Metals by 7196A

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW28SS01 (0-5')
3/3/2016 2:12:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-08 (Soil)									
Total Metals by 7196A									
Hexavalent Chromium	**2.14**	**0.773**	2.58	mg/kg dry	5	1550283	03/08/2016	03/09/2016	J
Total Metals by 7471A									
Mercury	**0.762**	**0.0104**	0.0312	mg/kg dry	2	1550213	03/07/2016	03/08/2016	
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND		0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND		0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND		0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND		0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND		0.00200	"	"	"	"	"	Ua

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3/3/2016 2:12:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-08 (Soil)

VOC by EPA 8260C

1,2-Dichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
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Project: CCOD Federal

RW28SS01 (0-5')
3/3/2016 2:12:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-08 (Soil)

VOC by EPA 8260C

Carbon disulfide	ND	0.00500	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW28SS01 (0-5')
3/3/2016 2:12:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-08 (Soil)									
VOC by EPA 8260C									
o-Xylene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
sec-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
Styrene	ND		0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND		0.00200	"	"	"	"	"	Ua
Toluene	ND		0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*116 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*96.8 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*118 %*		*70-130*			"	"	"	

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

RW32SS01 (10-15')
3/2/2016 12:22:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-09 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6C0802	03/08/2016	03/09/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*68.0 %*		*59-131*			"	"	"	
PAH by 8270D SIM									
Acenaphthene	ND	0.00204	0.00817	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Acenaphthylene	ND	0.00204	0.00817	"	"	"	"	"	U
Anthracene	ND	0.00204	0.00817	"	"	"	"	"	U
Benzo(a)anthracene	ND	0.00204	0.00817	"	"	"	"	"	U
Benzo(a)pyrene	ND	0.00204	0.00817	"	"	"	"	"	U
Benzo(b)fluoranthene	ND	0.00204	0.00817	"	"	"	"	"	U
Benzo(ghi)perylene	ND	0.00204	0.00817	"	"	"	"	"	U
Benzo(k)fluoranthene	ND	0.00204	0.00817	"	"	"	"	"	U
Chrysene	ND	0.00204	0.00817	"	"	"	"	"	U
Dibenzo(a,h)anthracene	ND	0.00204	0.00817	"	"	"	"	"	U
Fluoranthene	ND	0.00204	0.00817	"	"	"	"	"	U
Fluorene	ND	0.00204	0.00817	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.00204	0.00817	"	"	"	"	"	U

Origins Laboratory, Inc.

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RW32SS01 (10-15')
3/2/2016 12:22:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X603072-09 (Soil)									
PAH by 8270D SIM									
Naphthalene	ND	0.00123	0.00817	mg/kg dry	1	1550304	03/08/2016	03/09/2016	U
Phenanthrene	ND	0.00204	0.00817	"	"	"	"	"	U
Pyrene	ND	0.00204	0.00817	"	"	"	"	"	U
Surrogate: 5-alpha-Androstane	*55 %*		*25-129*			"	"	"	
Total Metals by 6010C									
Arsenic	ND	0.611	3.67	mg/kg dry	1	1550259	03/07/2016	03/08/2016	U
Barium	**364**	**0.122**	0.611	"	"	"	"	"	
Cadmium	**0.426**	**0.122**	0.611	"	"	"	"	"	J
Chromium	**14.9**	**0.183**	0.611	"	"	"	"	"	
Lead	**9.95**	**0.403**	1.22	"	"	"	"	"	
Selenium	**1.26**	**0.611**	3.67	"	"	"	"	"	J
Silver	**1.54**	**0.122**	0.611	"	"	"	"	"	
Total Metals by 7471A									
Mercury	ND	0.00416	0.0124	mg/kg dry	1	1550213	"	03/08/2016	U
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua

Origins Laboratory, Inc.

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Project: CCOD Federal

RW32SS01 (10-15')
3/2/2016 12:22:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-09 (Soil)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua

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3/2/2016 12:22:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-09 (Soil)

VOC by EPA 8260C

2-Butanone	ND	0.0100	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

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RW32SS01 (10-15')
3/2/2016 12:22:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X603072-09 (Soil)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

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Project Number: 11600702.2102
Project: CCOD Federal

RW32SS01 (10-15')
3/2/2016 12:22:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X603072-09 (Soil)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		0.00200	mg/kg	1	B6C0801	03/08/2016	03/08/2016	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*114 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*93.0 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*107 %*		*70-130*			"	"	"	

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Blank (B6C0801-BLK1)					Prepared: 03/08/2016 Analyzed: 03/08/2016					
1,1,1,2-Tetrachloroethane	ND	0.00200	mg/kg							Ua
1,1,1-Trichloroethane	ND	0.00200	"							Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"							Ua
1,1,2-Trichloroethane	ND	0.00200	"							Ua
1,1-Dichloroethane	ND	0.00200	"							Ua
1,1-Dichloroethene	ND	0.00200	"							Ua
1,1-Dichloropropene	ND	0.00200	"							Ua
1,2,3-Trichlorobenzene	ND	0.00500	"							Ua
1,2,3-Trichloropropane	ND	0.00500	"							Ua
1,2,4-Trichlorobenzene	ND	0.00500	"							Ua
1,2,4-Trimethylbenzene	ND	0.00200	"							Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"							Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"							Ua
1,2-Dichlorobenzene	ND	0.00200	"							Ua
1,2-Dichloroethane	ND	0.00200	"							Ua
1,2-Dichloropropane	ND	0.00200	"							Ua
1,3,5-Trimethylbenzene	ND	0.00200	"							Ua
1,3-Dichlorobenzene	ND	0.00200	"							Ua
1,3-Dichloropropane	ND	0.00200	"							Ua
1,4-Dichlorobenzene	ND	0.00200	"							Ua
2,2-Dichloropropane	ND	0.00200	"							Ua
2-Butanone	ND	0.0100	"							Ua
2-Chlorotoluene	ND	0.00200	"							Ua
2-Hexanone	ND	0.0100	"							Ua
4-Chlorotoluene	ND	0.00200	"							Ua
4-Isopropyltoluene	ND	0.00200	"							Ua

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Blank (B6C0801-BLK1)				Prepared: 03/08/2016 Analyzed: 03/08/2016						
4-Methyl-2-pentanone	ND	0.0100	mg/kg							Ua
Acetone	ND	0.0200	"							Ua
Benzene	ND	0.00200	"							Ua
Bromobenzene	ND	0.00200	"							Ua
Bromochloromethane	ND	0.00200	"							Ua
Bromodichloromethane	ND	0.00200	"							Ua
Bromoform	ND	0.00200	"							Ua
Bromomethane	ND	0.00200	"							Ua
Carbon disulfide	ND	0.00500	"							Ua
Carbon tetrachloride	ND	0.00200	"							Ua
Chlorobenzene	ND	0.00200	"							Ua
Chloroethane	ND	0.00500	"							Ua
Chloroform	ND	0.00200	"							Ua
Chloromethane	ND	0.00200	"							Ua
cis-1,2-Dichloroethene	ND	0.00200	"							Ua
cis-1,3-Dichloropropene	ND	0.00200	"							Ua
Dibromochloromethane	ND	0.00200	"							Ua
Dibromomethane	ND	0.00200	"							Ua
Ethylbenzene	ND	0.00200	"							Ua
Hexachlorobutadiene	ND	0.00500	"							Ua
Iodomethane	ND	0.0150	"							Ua
Isopropylbenzene	ND	0.00200	"							Ua
m,p-Xylene	ND	0.00400	"							Ua
Methyl tert-Butyl Ether	ND	0.00200	"							Ua
Methylene Chloride	ND	0.0200	"							Ua
Naphthalene	ND	0.0100	"							Ua

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Blank (B6C0801-BLK1)					Prepared: 03/08/2016 Analyzed: 03/08/2016					
n-Butylbenzene	ND	0.00200	mg/kg							Ua
n-Propylbenzene	ND	0.00200	"							Ua
o-Xylene	ND	0.00200	"							Ua
sec-Butylbenzene	ND	0.00200	"							Ua
Styrene	ND	0.00200	"							Ua
tert-Butylbenzene	ND	0.00200	"							Ua
Tetrachloroethene	ND	0.00200	"							Ua
Toluene	ND	0.00200	"							Ua
trans-1,2-Dichloroethene	ND	0.00200	"							Ua
trans-1,3-Dichloropropene	ND	0.00200	"							Ua
Trichloroethene	ND	0.00200	"							Ua
Trichlorofluoromethane	ND	0.00300	"							Ua
Vinyl chloride	ND	0.00200	"							Ua
Surrogate: 1,2-Dichloroethane-d4	*70*		*ug/L*	*62.5*		*112*	*70-130*			
Surrogate: Toluene-d8	*59*		*"*	*62.5*		*93.7*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*65*		*"*	*62.5*		*104*	*70-130*			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
LCS (B6C0801-BS1)					Prepared: 03/08/2016 Analyzed: 03/08/2016					
1,1,1,2-Tetrachloroethane	0.0961	0.00200	mg/kg	0.100		96.1	70-130			
1,1,1-Trichloroethane	0.105	0.00200	"	0.100		105	70-130			
1,1,2,2-Tetrachloroethane	0.0920	0.00200	"	0.100		92.0	70-130			
1,1,2-Trichloroethane	0.0960	0.00200	"	0.100		96.0	70-130			
1,1-Dichloroethane	0.108	0.00200	"	0.100		108	70-130			
1,1-Dichloroethene	0.102	0.00200	"	0.100		102	70-130			
1,1-Dichloropropene	0.105	0.00200	"	0.100		105	70-130			
1,2,3-Trichlorobenzene	0.103	0.00500	"	0.100		103	70-130			
1,2,3-Trichloropropane	0.104	0.00500	"	0.100		104	70-130			
1,2,4-Trichlorobenzene	0.0995	0.00500	"	0.100		99.5	70-130			
1,2,4-Trimethylbenzene	0.103	0.00200	"	0.100		103	70-130			
1,2-Dibromo-3-chloropropane	0.0956	0.00500	"	0.100		95.6	70-130			
1,2-Dibromoethane (EDB)	0.0964	0.00200	"	0.100		96.4	70-130			
1,2-Dichlorobenzene	0.0960	0.00200	"	0.100		96.0	70-130			
1,2-Dichloroethane	0.109	0.00200	"	0.100		109	70-130			
1,2-Dichloropropane	0.106	0.00200	"	0.100		106	70-130			
1,3,5-Trimethylbenzene	0.103	0.00200	"	0.100		103	70-130			
1,3-Dichlorobenzene	0.0957	0.00200	"	0.100		95.7	70-130			
1,3-Dichloropropane	0.0997	0.00200	"	0.100		99.7	70-130			
1,4-Dichlorobenzene	0.0852	0.00200	"	0.100		85.2	70-130			
2,2-Dichloropropane	0.106	0.00200	"	0.100		106	70-130			
2-Butanone	0.591	0.0100	"	0.500		118	70-130			
2-Chlorotoluene	0.103	0.00200	"	0.100		103	70-130			
2-Hexanone	0.507	0.0100	"	0.500		101	70-130			
4-Chlorotoluene	0.124	0.00200	"	0.100		124	70-130			
4-Isopropyltoluene	0.0999	0.00200	"	0.100		99.9	70-130			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
LCS (B6C0801-BS1)					Prepared: 03/08/2016 Analyzed: 03/08/2016					
4-Methyl-2-pentanone	0.527	0.0100	mg/kg	0.500		105	70-130			
Acetone	0.526	0.0200	"	0.500		105	70-130			
Benzene	0.108	0.00200	"	0.100		108	70-130			
Bromobenzene	0.107	0.00200	"	0.100		107	70-130			
Bromochloromethane	0.103	0.00200	"	0.100		103	70-130			
Bromodichloromethane	0.107	0.00200	"	0.100		107	70-130			
Bromoform	0.0905	0.00200	"	0.100		90.5	70-130			
Bromomethane	0.0881	0.00200	"	0.100		88.1	70-130			
Carbon disulfide	0.0990	0.00500	"	0.100		99.0	70-130			
Carbon tetrachloride	0.101	0.00200	"	0.100		101	70-130			
Chlorobenzene	0.0954	0.00200	"	0.100		95.4	70-130			
Chloroethane	0.0896	0.00500	"	0.100		89.6	70-130			
Chloroform	0.108	0.00200	"	0.100		108	70-130			
Chloromethane	0.0808	0.00200	"	0.100		80.8	70-130			
cis-1,2-Dichloroethene	0.107	0.00200	"	0.100		107	70-130			
cis-1,3-Dichloropropene	0.103	0.00200	"	0.100		103	70-130			
Dibromochloromethane	0.0946	0.00200	"	0.100		94.6	70-130			
Dibromomethane	0.0969	0.00200	"	0.100		96.9	70-130			
Ethylbenzene	0.104	0.00200	"	0.100		104	70-130			
Hexachlorobutadiene	0.0928	0.00500	"	0.100		92.8	70-130			
Iodomethane	0.0995	0.0150	"	0.100		99.5	70-130			
Isopropylbenzene	0.103	0.00200	"	0.100		103	70-130			
m,p-Xylene	0.209	0.00400	"	0.200		104	70-130			
Methyl tert-Butyl Ether	0.107	0.00200	"	0.100		107	70-130			
Methylene Chloride	0.0939	0.0200	"	0.100		93.9	70-130			
Naphthalene	0.106	0.0100	"	0.100		106	70-130			

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
LCS (B6C0801-BS1)					Prepared: 03/08/2016 Analyzed: 03/08/2016					
n-Butylbenzene	0.103	0.00200	mg/kg	0.100		103	70-130			
n-Propylbenzene	0.110	0.00200	"	0.100		110	70-130			
o-Xylene	0.103	0.00200	"	0.100		103	70-130			
sec-Butylbenzene	0.106	0.00200	"	0.100		106	70-130			
Styrene	0.101	0.00200	"	0.100		101	70-130			
tert-Butylbenzene	0.103	0.00200	"	0.100		103	70-130			
Tetrachloroethene	0.0922	0.00200	"	0.100		92.2	70-130			
Toluene	0.101	0.00200	"	0.100		101	70-130			
trans-1,2-Dichloroethene	0.106	0.00200	"	0.100		106	70-130			
trans-1,3-Dichloropropene	0.103	0.00200	"	0.100		103	70-130			
Trichloroethene	0.105	0.00200	"	0.100		105	70-130			
Trichlorofluoromethane	0.0947	0.00300	"	0.100		94.7	70-130			
Vinyl chloride	0.0826	0.00200	"	0.100		82.6	70-130			
Surrogate: 1,2-Dichloroethane-d4	*64*		*ug/L*	*62.5*		*103*	*70-130*			
Surrogate: Toluene-d8	*60*		*"*	*62.5*		*95.3*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*67*		*"*	*62.5*		*107*	*70-130*			

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Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Matrix Spike (B6C0801-MS1)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/08/2016					
1,1,1,2-Tetrachloroethane	0.0963	0.00200	mg/kg	0.100	ND	96.3	70-130			
1,1,1-Trichloroethane	0.0987	0.00200	"	0.100	ND	98.7	70-130			
1,1,2,2-Tetrachloroethane	0.103	0.00200	"	0.100	ND	103	70-130			
1,1,2-Trichloroethane	0.0998	0.00200	"	0.100	ND	99.8	70-130			
1,1-Dichloroethane	0.105	0.00200	"	0.100	ND	105	70-130			
1,1-Dichloroethene	0.0966	0.00200	"	0.100	ND	96.6	70-130			
1,1-Dichloropropene	0.104	0.00200	"	0.100	ND	104	70-130			
1,2,3-Trichlorobenzene	0.0953	0.00500	"	0.100	ND	95.3	70-130			
1,2,3-Trichloropropane	0.103	0.00500	"	0.100	ND	103	70-130			
1,2,4-Trichlorobenzene	0.0935	0.00500	"	0.100	ND	93.5	70-130			
1,2,4-Trimethylbenzene	0.115	0.00200	"	0.100	ND	115	70-130			
1,2-Dibromo-3-chloropropane	0.0953	0.00500	"	0.100	ND	95.3	70-130			
1,2-Dibromoethane (EDB)	0.0976	0.00200	"	0.100	ND	97.6	70-130			
1,2-Dichlorobenzene	0.0947	0.00200	"	0.100	ND	94.7	70-130			
1,2-Dichloroethane	0.111	0.00200	"	0.100	ND	111	70-130			
1,2-Dichloropropane	0.105	0.00200	"	0.100	ND	105	70-130			
1,3,5-Trimethylbenzene	0.101	0.00200	"	0.100	ND	101	70-130			
1,3-Dichlorobenzene	0.0952	0.00200	"	0.100	ND	95.2	70-130			
1,3-Dichloropropane	0.0996	0.00200	"	0.100	ND	99.6	70-130			
1,4-Dichlorobenzene	0.0830	0.00200	"	0.100	ND	83.0	70-130			
2,2-Dichloropropane	0.101	0.00200	"	0.100	ND	101	70-130			
2-Butanone	0.560	0.0100	"	0.500	ND	112	70-130			
2-Chlorotoluene	0.104	0.00200	"	0.100	ND	104	70-130			
2-Hexanone	0.525	0.0100	"	0.500	ND	105	70-130			
4-Chlorotoluene	0.126	0.00200	"	0.100	ND	126	70-130			
4-Isopropyltoluene	0.0949	0.00200	"	0.100	ND	94.9	70-130			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Matrix Spike (B6C0801-MS1)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/08/2016					
4-Methyl-2-pentanone	0.510	0.0100	mg/kg	0.500	ND	102	70-130			
Acetone	0.642	0.0200	"	0.500	ND	128	70-130			
Benzene	0.112	0.00200	"	0.100	ND	112	70-130			
Bromobenzene	0.106	0.00200	"	0.100	ND	106	70-130			
Bromochloromethane	0.103	0.00200	"	0.100	ND	103	70-130			
Bromodichloromethane	0.106	0.00200	"	0.100	ND	106	70-130			
Bromoform	0.0934	0.00200	"	0.100	ND	93.4	70-130			
Bromomethane	0.0550	0.00200	"	0.100	ND	55.0	70-130			QM-07
Carbon disulfide	0.145	0.00500	"	0.100	ND	145	70-130			QM-07
Carbon tetrachloride	0.0986	0.00200	"	0.100	ND	98.6	70-130			
Chlorobenzene	0.0947	0.00200	"	0.100	ND	94.7	70-130			
Chloroethane	0.0568	0.00500	"	0.100	ND	56.8	70-130			QM-07
Chloroform	0.107	0.00200	"	0.100	ND	107	70-130			
Chloromethane	0.0490	0.00200	"	0.100	ND	49.0	70-130			QM-07
cis-1,2-Dichloroethene	0.105	0.00200	"	0.100	ND	105	70-130			
cis-1,3-Dichloropropene	0.104	0.00200	"	0.100	ND	104	70-130			
Dibromochloromethane	0.0962	0.00200	"	0.100	ND	96.2	70-130			
Dibromomethane	0.100	0.00200	"	0.100	ND	100	70-130			
Ethylbenzene	0.111	0.00200	"	0.100	ND	111	70-130			
Hexachlorobutadiene	0.0856	0.00500	"	0.100	ND	85.6	70-130			
Iodomethane	0.195	0.0150	"	0.100	ND	195	70-130			QM-07
Isopropylbenzene	0.101	0.00200	"	0.100	ND	101	70-130			
m,p-Xylene	0.237	0.00400	"	0.200	ND	119	70-130			
Methyl tert-Butyl Ether	0.107	0.00200	"	0.100	ND	107	70-130			
Methylene Chloride	0.102	0.0200	"	0.100	ND	102	70-130			
Naphthalene	0.102	0.0100	"	0.100	0.000860	101	70-130			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Matrix Spike (B6C0801-MS1)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/08/2016					
n-Butylbenzene	0.0980	0.00200	mg/kg	0.100	ND	98.0	70-130			
n-Propylbenzene	0.109	0.00200	"	0.100	ND	109	70-130			
o-Xylene	0.115	0.00200	"	0.100	ND	115	70-130			
sec-Butylbenzene	0.100	0.00200	"	0.100	ND	100	70-130			
Styrene	0.102	0.00200	"	0.100	ND	102	70-130			
tert-Butylbenzene	0.0984	0.00200	"	0.100	ND	98.4	70-130			
Tetrachloroethene	0.0903	0.00200	"	0.100	ND	90.3	70-130			
Toluene	0.153	0.00200	"	0.100	ND	153	70-130			QM-07
trans-1,2-Dichloroethene	0.102	0.00200	"	0.100	ND	102	70-130			
trans-1,3-Dichloropropene	0.104	0.00200	"	0.100	ND	104	70-130			
Trichloroethene	0.0990	0.00200	"	0.100	ND	99.0	70-130			
Trichlorofluoromethane	0.0580	0.00300	"	0.100	ND	58.0	70-130			QM-07
Vinyl chloride	0.0524	0.00200	"	0.100	ND	52.4	70-130			QM-07
Surrogate: 1,2-Dichloroethane-d4	*68*		*ug/L*	*62.5*		*109*	*70-130*			
Surrogate: Toluene-d8	*60*		*"*	*62.5*		*96.0*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*68*		*"*	*62.5*		*109*	*70-130*			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Matrix Spike Dup (B6C0801-MSD1)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/08/2016					
1,1,1,2-Tetrachloroethane	0.0930	0.00200	mg/kg	0.100	ND	93.0	70-130	3.53	20	
1,1,1-Trichloroethane	0.102	0.00200	"	0.100	ND	102	70-130	3.48	20	
1,1,2,2-Tetrachloroethane	0.105	0.00200	"	0.100	ND	105	70-130	1.66	20	
1,1,2-Trichloroethane	0.0989	0.00200	"	0.100	ND	98.9	70-130	0.926	20	
1,1-Dichloroethane	0.105	0.00200	"	0.100	ND	105	70-130	0.267	20	
1,1-Dichloroethene	0.0975	0.00200	"	0.100	ND	97.5	70-130	0.907	20	
1,1-Dichloropropene	0.103	0.00200	"	0.100	ND	103	70-130	0.813	20	
1,2,3-Trichlorobenzene	0.0937	0.00500	"	0.100	ND	93.7	70-130	1.67	20	
1,2,3-Trichloropropane	0.0993	0.00500	"	0.100	ND	99.3	70-130	3.52	20	
1,2,4-Trichlorobenzene	0.0925	0.00500	"	0.100	ND	92.5	70-130	1.01	20	
1,2,4-Trimethylbenzene	0.113	0.00200	"	0.100	ND	113	70-130	1.46	20	
1,2-Dibromo-3-chloropropane	0.0943	0.00500	"	0.100	ND	94.3	70-130	1.01	20	
1,2-Dibromoethane (EDB)	0.0965	0.00200	"	0.100	ND	96.5	70-130	1.17	20	
1,2-Dichlorobenzene	0.0938	0.00200	"	0.100	ND	93.8	70-130	0.955	20	
1,2-Dichloroethane	0.111	0.00200	"	0.100	ND	111	70-130	0.108	20	
1,2-Dichloropropane	0.105	0.00200	"	0.100	ND	105	70-130	0.190	20	
1,3,5-Trimethylbenzene	0.0989	0.00200	"	0.100	ND	98.9	70-130	1.92	20	
1,3-Dichlorobenzene	0.0918	0.00200	"	0.100	ND	91.8	70-130	3.64	20	
1,3-Dichloropropane	0.0989	0.00200	"	0.100	ND	98.9	70-130	0.705	20	
1,4-Dichlorobenzene	0.105	0.00200	"	0.100	ND	105	70-130	23.7	20	QR-03
2,2-Dichloropropane	0.105	0.00200	"	0.100	ND	105	70-130	3.07	20	
2-Butanone	0.546	0.0100	"	0.500	ND	109	70-130	2.47	20	
2-Chlorotoluene	0.100	0.00200	"	0.100	ND	100	70-130	4.13	20	
2-Hexanone	0.517	0.0100	"	0.500	ND	103	70-130	1.50	20	
4-Chlorotoluene	0.121	0.00200	"	0.100	ND	121	70-130	3.98	20	
4-Isopropyltoluene	0.0929	0.00200	"	0.100	ND	92.9	70-130	2.09	20	

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Matrix Spike Dup (B6C0801-MSD1)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/08/2016					
4-Methyl-2-pentanone	0.508	0.0100	mg/kg	0.500	ND	102	70-130	0.476	20	
Acetone	0.588	0.0200	"	0.500	ND	118	70-130	8.66	20	
Benzene	0.113	0.00200	"	0.100	ND	113	70-130	0.249	20	
Bromobenzene	0.101	0.00200	"	0.100	ND	101	70-130	4.48	20	
Bromochloromethane	0.105	0.00200	"	0.100	ND	105	70-130	2.27	20	
Bromodichloromethane	0.107	0.00200	"	0.100	ND	107	70-130	0.696	20	
Bromoform	0.0895	0.00200	"	0.100	ND	89.5	70-130	4.29	20	
Bromomethane	0.0573	0.00200	"	0.100	ND	57.3	70-130	4.10	20	QM-07
Carbon disulfide	0.146	0.00500	"	0.100	ND	146	70-130	0.467	20	QM-07
Carbon tetrachloride	0.0997	0.00200	"	0.100	ND	99.7	70-130	1.13	20	
Chlorobenzene	0.0931	0.00200	"	0.100	ND	93.1	70-130	1.77	20	
Chloroethane	0.0593	0.00500	"	0.100	ND	59.3	70-130	4.34	20	QM-07
Chloroform	0.107	0.00200	"	0.100	ND	107	70-130	0.373	20	
Chloromethane	0.0523	0.00200	"	0.100	ND	52.3	70-130	6.47	20	QM-07
cis-1,2-Dichloroethene	0.107	0.00200	"	0.100	ND	107	70-130	2.31	20	
cis-1,3-Dichloropropene	0.103	0.00200	"	0.100	ND	103	70-130	1.39	20	
Dibromochloromethane	0.0952	0.00200	"	0.100	ND	95.2	70-130	1.00	20	
Dibromomethane	0.0993	0.00200	"	0.100	ND	99.3	70-130	1.02	20	
Ethylbenzene	0.105	0.00200	"	0.100	ND	105	70-130	5.31	20	
Hexachlorobutadiene	0.0847	0.00500	"	0.100	ND	84.7	70-130	1.03	20	
Iodomethane	0.197	0.0150	"	0.100	ND	197	70-130	1.15	20	QM-07
Isopropylbenzene	0.0967	0.00200	"	0.100	ND	96.7	70-130	4.43	20	
m,p-Xylene	0.226	0.00400	"	0.200	ND	113	70-130	4.90	20	
Methyl tert-Butyl Ether	0.112	0.00200	"	0.100	ND	112	70-130	4.67	20	
Methylene Chloride	0.101	0.0200	"	0.100	ND	101	70-130	0.751	20	
Naphthalene	0.102	0.0100	"	0.100	0.000860	101	70-130	0.510	20	

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0801 - EPA 5030 (soil)										
Matrix Spike Dup (B6C0801-MSD1)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/08/2016					
n-Butylbenzene	0.0962	0.00200	mg/kg	0.100	ND	96.2	70-130	1.92	20	
n-Propylbenzene	0.104	0.00200	"	0.100	ND	104	70-130	4.92	20	
o-Xylene	0.110	0.00200	"	0.100	ND	110	70-130	5.09	20	
sec-Butylbenzene	0.0969	0.00200	"	0.100	ND	96.9	70-130	3.41	20	
Styrene	0.0964	0.00200	"	0.100	ND	96.4	70-130	5.62	20	
tert-Butylbenzene	0.0955	0.00200	"	0.100	ND	95.5	70-130	2.91	20	
Tetrachloroethene	0.0873	0.00200	"	0.100	ND	87.3	70-130	3.42	20	
Toluene	0.151	0.00200	"	0.100	ND	151	70-130	1.42	20	QM-07
trans-1,2-Dichloroethene	0.102	0.00200	"	0.100	ND	102	70-130	0.0393	20	
trans-1,3-Dichloropropene	0.103	0.00200	"	0.100	ND	103	70-130	1.39	20	
Trichloroethene	0.0982	0.00200	"	0.100	ND	98.2	70-130	0.811	20	
Trichlorofluoromethane	0.0591	0.00300	"	0.100	ND	59.1	70-130	1.95	20	QM-07
Vinyl chloride	0.0556	0.00200	"	0.100	ND	55.6	70-130	6.00	20	QM-07
Surrogate: 1,2-Dichloroethane-d4	*67*		*ug/L*	*62.5*		*107*	*70-130*			
Surrogate: Toluene-d8	*60*		*"*	*62.5*		*95.3*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*66*		*"*	*62.5*		*106*	*70-130*			

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6C0802 - EPA 3580										
Blank (B6C0802-BLK1)						Prepared: 03/08/2016 Analyzed: 03/09/2016				
Gasoline (C6-C10)	ND	50.0	mg/kg							Ua
Diesel (C10-C28)	ND	50.0	"							Ua
Surrogate: o-Terphenyl	*42*		*"*	*50.0*		*84.1*	*59-131*			
LCS (B6C0802-BS1)						Prepared: 03/08/2016 Analyzed: 03/09/2016				
Gasoline (C6-C10)	1060	50.0	mg/kg	1000		106	59-133			
Diesel (C10-C28)	1040	50.0	"	1000		104	64-121			
Surrogate: o-Terphenyl	*47*		*"*	*50.0*		*93.0*	*59-131*			
Matrix Spike (B6C0802-MS1)		**Source: X603072-01**				Prepared: 03/08/2016 Analyzed: 03/09/2016				
Gasoline (C6-C10)	976	50.0	mg/kg	1000	18.7	95.7	57-139			
Diesel (C10-C28)	900	50.0	"	1000	ND	90.0	53-125			
Surrogate: o-Terphenyl	*45*		*"*	*50.0*		*89.6*	*59-131*			
Matrix Spike Dup (B6C0802-MSD1)		**Source: X603072-01**				Prepared: 03/08/2016 Analyzed: 03/09/2016				
Gasoline (C6-C10)	943	50.0	mg/kg	1000	18.7	92.4	57-139	3.38	20	
Diesel (C10-C28)	915	50.0	"	1000	ND	91.5	53-125	1.68	20	
Surrogate: o-Terphenyl	*45*		*"*	*50.0*		*89.5*	*59-131*			

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

TCLP Metals by 1311/6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1583733 - SW846 3010A										
MS (1203588631 S)		**Source: X603072-04**			Prepared: 07/21/2016 Analyzed: 07/22/2016					
Lead	5.31	0.100	mg/L	5.00	0.190	102	75-125			
TB (1203588632-BLK)					Prepared: 07/21/2016 Analyzed: 07/22/2016					
Lead	ND	0.100	mg/L				-			U
BLANK (1203589721-BLK)					Prepared: 07/21/2016 Analyzed: 07/22/2016					
Lead	ND	0.100	mg/L				-			U
LCS (1203589722-BKS)					Prepared: 07/21/2016 Analyzed: 07/22/2016					
Lead	5.15	0.100	mg/L	5.00		103	80-120			
DUP (1203589723 D)		**Source: X603072-04**			Prepared: 07/21/2016 Analyzed: 07/22/2016					
Lead	0.196	0.100	mg/L		0.190		0-20	2.94	20	
Batch 1584783 - SW846 3010A										
MS (1203591540 S)		**Source: X603072-08**			Prepared: 07/26/2016 Analyzed: 07/26/2016					
Lead	4.88	0.100	mg/L	5.00	0.292	91.7	75-125			
TB (1203591541-BLK)					Prepared: 07/26/2016 Analyzed: 07/26/2016					
Lead	ND	0.100	mg/L				-			U
BLANK (1203592423-BLK)					Prepared: 07/26/2016 Analyzed: 07/26/2016					
Lead	ND	0.100	mg/L				-			U
LCS (1203592424-BKS)					Prepared: 07/26/2016 Analyzed: 07/26/2016					
Lead	4.80	0.100	mg/L	5.00		96	80-120			

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

TCLP Metals by 1311/6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1584783 - SW846 3010A										
DUP (1203592425 D)		**Source: X603072-08**			Prepared: 07/26/2016 Analyzed: 07/26/2016					
Lead	0.296	0.100	mg/L		0.292		0-20	1.17	20	

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PAH by 8270D SIM - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550304 - SW846 3541										
BLANK (1203503347-BLK)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Acenaphthylene	ND	0.00666	mg/kg				-			U
Naphthalene	ND	0.00666	"				-			U
Acenaphthene	ND	0.00666	"				-			U
Anthracene	ND	0.00666	"				-			U
Benzo(a)pyrene	ND	0.00666	"				-			U
Benzo(b)fluoranthene	ND	0.00666	"				-			U
Benzo(ghi)perylene	ND	0.00666	"				-			U
Benzo(k)fluoranthene	ND	0.00666	"				-			U
Chrysene	ND	0.00666	"				-			U
Dibenzo(a,h)anthracene	ND	0.00666	"				-			U
Fluoranthene	ND	0.00666	"				-			U
Benzo(a)anthracene	ND	0.00666	"				-			U
Indeno(1,2,3-cd)pyrene	ND	0.00666	"				-			U
Phenanthrene	0.002	0.00666	"				-			J
Pyrene	ND	0.00666	"				-			U
Fluorene	ND	0.00666	"				-			U
Surrogate: 5-alpha-Androstane	*0.101*		"	*0.166*		*61*	*25-129*			
LCS (1203503348-BKS)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Fluoranthene	0.257	0.00666	mg/kg	0.333		77	39-113			
Benzo(b)fluoranthene	0.296	0.00666	"	0.333		89	34-119			
Acenaphthylene	0.295	0.00666	"	0.333		89	34-109			
Pyrene	0.282	0.00666	"	0.333		85	28-108			
Anthracene	0.246	0.00666	"	0.333		74	37-107			
Benzo(a)anthracene	0.300	0.00666	"	0.333		90	36-108			
Acenaphthene	0.283	0.00666	"	0.333		85	37-100			
Fluorene	0.255	0.00666	"	0.333		77	36-109			

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Project Number: 11600702.2102
Project: CCOD Federal

PAH by 8270D SIM - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550304 - SW846 3541										
LCS (1203503348-BKS)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Indeno(1,2,3-cd)pyrene	0.363	0.00666	mg/kg	0.333		109	31-127			
Dibenzo(a,h)anthracene	0.371	0.00666	"	0.333		111	29-133			
Chrysene	0.293	0.00666	"	0.333		88	36-104			
Benzo(k)fluoranthene	0.298	0.00666	"	0.333		90	38-113			
Benzo(ghi)perylene	0.343	0.00666	"	0.333		103	23-123			
Phenanthrene	0.246	0.00666	"	0.333		74	37-100			B
Naphthalene	0.271	0.00666	"	0.333		81	38-101			
Benzo(a)pyrene	0.287	0.00666	"	0.333		86	35-117			
Surrogate: 5-alpha-Androstane	*0.113*		"	*0.167*		*68*	*25-129*			
MS (1203503349 S)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Chrysene	0.398	0.00851	mg/kg dry	0.426	<0.00213	94	18-121			
Benzo(k)fluoranthene	0.418	0.00851	"	0.426	<0.00213	98	23-128			
Benzo(ghi)perylene	0.447	0.00851	"	0.426	<0.00213	105	18-118			
Benzo(b)fluoranthene	0.408	0.00851	"	0.426	<0.00213	96	20-134			
Benzo(a)pyrene	0.393	0.00851	"	0.426	<0.00213	92	20-130			
Benzo(a)anthracene	0.408	0.00851	"	0.426	<0.00213	96	23-124			
Anthracene	0.324	0.00851	"	0.426	<0.00213	76	23-115			
Acenaphthylene	0.378	0.00851	"	0.426	<0.00213	89	19-116			
Fluoranthene	0.335	0.00851	"	0.426	<0.00213	79	21-124			
Acenaphthene	0.364	0.00851	"	0.426	<0.00213	86	18-115			
Dibenzo(a,h)anthracene	0.486	0.00851	"	0.426	<0.00213	114	12-132			
Fluorene	0.329	0.00851	"	0.426	<0.00213	77	21-118			
Indeno(1,2,3-cd)pyrene	0.473	0.00851	"	0.426	<0.00213	111	11-130			
Naphthalene	0.345	0.00851	"	0.426	<0.00128	81	14-114			
Phenanthrene	0.323	0.00851	"	0.426	0.00256	75	24-106			B
Pyrene	0.381	0.00851	"	0.426	<0.00213	89	16-122			

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Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

PAH by 8270D SIM - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550304 - SW846 3541										
MS (1203503349 S)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Surrogate: 5-alpha-Androstane	*0.144*		*mg/kg dry*	*0.213*	*0.154*	*68*	*25-129*			
MSD (1203503350 SD)		**Source: X603072-01**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Anthracene	0.362	0.00851	mg/kg dry	0.426	<0.00213	85	23-115	11	30	
Phenanthrene	0.364	0.00851	"	0.426	0.00256	85	24-106	12	30	B
Acenaphthylene	0.414	0.00851	"	0.426	<0.00213	97	19-116	9	30	
Pyrene	0.434	0.00851	"	0.426	<0.00213	102	16-122	13	30	
Benzo(a)anthracene	0.440	0.00851	"	0.426	<0.00213	103	23-124	8	30	
Benzo(a)pyrene	0.420	0.00851	"	0.426	<0.00213	99	20-130	7	30	
Benzo(b)fluoranthene	0.425	0.00851	"	0.426	<0.00213	100	20-134	4	30	
Benzo(ghi)perylene	0.487	0.00851	"	0.426	<0.00213	114	18-118	9	30	
Benzo(k)fluoranthene	0.443	0.00851	"	0.426	<0.00213	104	23-128	6	30	
Chrysene	0.440	0.00851	"	0.426	<0.00213	103	18-121	10	30	
Dibenzo(a,h)anthracene	0.537	0.00851	"	0.426	<0.00213	126	12-132	10	30	
Fluoranthene	0.372	0.00851	"	0.426	<0.00213	87	21-124	10	30	
Fluorene	0.366	0.00851	"	0.426	<0.00213	86	21-118	11	30	
Indeno(1,2,3-cd)pyrene	0.510	0.00851	"	0.426	<0.00213	120	11-130	8	30	
Naphthalene	0.363	0.00851	"	0.426	<0.00128	85	14-114	5	30	
Acenaphthene	0.404	0.00851	"	0.426	<0.00213	95	18-115	10	30	
Surrogate: 5-alpha-Androstane	*0.158*		*"*	*0.213*	*0.154*	*74*	*25-129*			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550259 - SW846 3050B										
BLANK (1203503249-BLK)					Prepared: 03/07/2016 Analyzed: 03/08/2016					
Lead	ND	0.988	mg/kg				-			U
Silver	ND	0.494	"				-			U
Selenium	ND	2.96	"				-			U
Cadmium	ND	0.494	"				-			U
Arsenic	ND	2.96	"				-			U
Chromium	0.186	0.494	"				-			J
Barium	ND	0.494	"				-			U
LCS (1203503250-BKS)					Prepared: 03/07/2016 Analyzed: 03/08/2016					
Chromium	47.4	0.480	mg/kg	48.0		98.9	80-120			
Arsenic	46.4	2.88	"	48.0		96.7	80-120			
Barium	46.8	0.480	"	48.0		97.5	80-120			
Lead	48.6	0.960	"	48.0		101	80-120			
Cadmium	48.8	0.480	"	48.0		102	80-120			
Selenium	47.7	2.88	"	48.0		99.4	80-120			
Silver	47.7	0.480	"	48.0		99.4	80-120			
DUP (1203503251 D)		**Source: X603072-01**			Prepared: 03/07/2016 Analyzed: 03/08/2016					
Silver	0.845	0.620	mg/kg dry		0.880		0-20	4.08	20	
Arsenic	ND	3.72	"		<0.620		0-20	75.6	20	U
Barium	243	0.620	"		272		0-20	11.2	20	
Cadmium	0.140	0.620	"		0.153		0-20	8.58	20	J
Chromium	10.9	0.620	"		10.7		0-20	2.26	20	
Selenium	ND	3.72	"		<0.620		0-20	NR	20	U
Lead	10.2	1.24	"		10.1		0-20	0.786	20	
MS (1203503252 S)		**Source: X603072-01**			Prepared: 03/07/2016 Analyzed: 03/08/2016					

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550259 - SW846 3050B										
MS (1203503252 S)		**Source: X603072-01**			Prepared: 03/07/2016 Analyzed: 03/08/2016					
Chromium	64.7	0.606	mg/kg dry	60.6	10.7	89.2	75-125			
Cadmium	53.0	0.606	"	60.6	0.153	87.2	75-125			
Lead	61.6	1.21	"	60.6	10.1	85	75-125			
Selenium	50.5	3.64	"	60.6	<0.606	83.4	75-125			
Silver	54.9	0.606	"	60.6	0.880	89.1	75-125			
Arsenic	50.4	3.64	"	60.6	<0.606	83.2	75-125			
Barium	304	0.606	"	60.6	272	51.9	75-125			

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Total Metals by 6020A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550257 - SW846 3050B										
BLANK (1203503244-BLK)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Copper	ND	.196	mg/kg				-			U
LCS (1203503245-BKS)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Copper	4.85	.192	mg/kg	4810		101	80-120			
DUP (1203503246 D)		**Source: X603072-08**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Copper	93.9	.252	mg/kg dry		165000		0-20	54.9	20	
MS (1203503247 S)		**Source: X603072-08**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Copper	113	.249	mg/kg dry	6220	165000	0	75-125			

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Total Metals by 7196A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550283 - SW846 3060A										
BLANK (1203503296-BLK)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Hexavalent Chromium	ND	0.398	mg/kg				-			U
LCS (1203503297-BKS)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Hexavalent Chromium	4.02	0.398	mg/kg	3.98		101	80-120			
ILCS (1203503298-ILCS)					Prepared: 03/08/2016 Analyzed: 03/09/2016					
Hexavalent Chromium	6.64	0.400	mg/kg	7.99		83	80-120			
DUP (1203503299 D)		**Source: X603072-08**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Hexavalent Chromium	2.15	2.59	mg/kg dry		2.14		0-50	0.477	50	J
MS (1203503302 S)		**Source: X603072-08**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Hexavalent Chromium	7.27	2.58	mg/kg dry	5.16	2.14	99.5	75-125			
MSD (1203503306 SD)		**Source: X603072-08**			Prepared: 03/08/2016 Analyzed: 03/09/2016					
Hexavalent Chromium	12.4	2.58	mg/kg dry	5.16	2.14	199	75-125	52.1	30	

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Total Metals by 7471A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1550213 - SW846 7471A Prep										
BLANK (1203503152-BLK)					Prepared: 03/07/2016 Analyzed: 03/08/2016					
Mercury	ND	0.0119	mg/kg				-			U
LCS (1203503153-BKS)					Prepared: 03/07/2016 Analyzed: 03/08/2016					
Mercury	0.112	0.0112	mg/kg	0.112		100	80-120			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702.2102
Project: CCOD Federal

Notes and Definitions

Ua	Sample is Non-Detect.
U	Result not detected above the detection limit
QR-03	The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Greater than the detection limit but less than the reporting limit
BJ	Blank contamination. Greater than the detection limit but less than the reporting limit
B	Blank contamination
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

May 13, 2016

Pinyon

Corinne Wardell

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

Project Name - Federal Phase II **Project Number - 11600702**

Attached are your analytical results for Federal Phase II received by Origins Laboratory, Inc. April 28, 2016. This project is associated with Origins project number X604294-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RW14SS02 (0-5)	X604294-01	Soil	April 27, 2016 14:20	04/28/2016 09:20
RW14SS01 (0-5)	X604294-02	Soil	April 27, 2016 16:05	04/28/2016 09:20
RW31SS01 (0-5)	X604294-03	Soil	April 27, 2016 12:07	04/28/2016 09:20

Sample RW13SS01 changed to RW14SS02 per the phone call from TIm Grenier on 05/02/16.

TCLP Pb added to sample 03 per the email from Corrine Wardell on 05/10/16.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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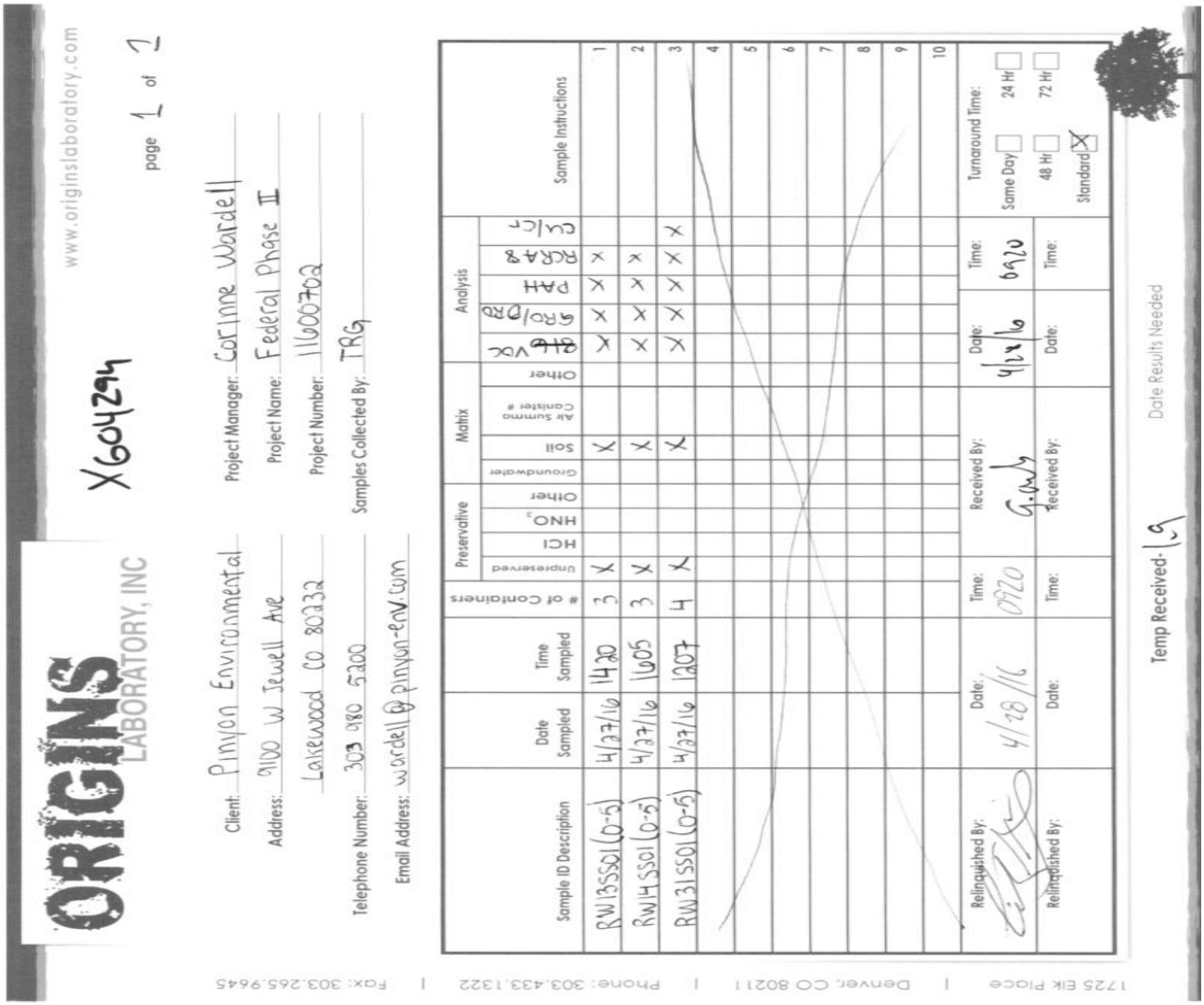
ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II



Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: X604294

Client: Pinyon
Client Project ID: Federal Phase II

Checklist Completed by: Jeff Smith
Date/time completed: 4/29/16

Shipped Via: HAND
(UPS, FedEx, Hand Delivered, Pick-up, etc.)
Airbill #: NA

Matrix(s) Received: (Check all that apply): X Soil/Solid ____ Water ____ Other: ____
(Describe)

Cooler Number/Temperature: 1 / 1.6 °C ____ / ____ °C ____ / ____ °C ____ / ____ °C

Thermometer ID: T003

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]?	X			
Is there ice present (document if blue ice is used)	X			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		X		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		X		
Were all samples received intact[1]?	X			
Was adequate sample volume provided[1]?	X			
Are short holding time analytes or samples with HTs due within 48 hours present[1]?		X		
Is a chain-of-custody (COC) present and filled out completely[1]?	X			
Does the COC agree with the number and type of sample bottles received[1]?	X			
Do the sample IDs on the bottle labels match the COC[1]?	X			
Is the COC properly relinquished by the client with date and time recorded[1]?	X			
For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.**			X	
Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / (pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)*			X	
Additional Comments (if any):				

[1]*If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager)

4/29/16
Date/Time Reviewed

Origins Laboratory, Inc.

Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS02 (0-5)
4/27/2016 2:20:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.								
X604294-01 (Soil)								
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	50.0	mg/kg	1	B6D2907	04/29/2016	05/05/2016	Ua
Diesel (C10-C28)	**361**	50.0	"	"	"	"	"	
Surrogate: o-Terphenyl	*79.7 %*	*59-131*			"	"	"	
PAH by 8270D SIM								
Acenaphthene	ND	0.0271	mg/kg	4	1563766	05/02/2016	05/02/2016	U
Acenaphthylene	ND	0.0271	"	"	"	"	"	U
Anthracene	ND	0.0271	"	"	"	"	"	U
Benzo(a)anthracene	**0.00813**	0.0271	"	"	"	"	"	J
Benzo(a)pyrene	ND	0.0271	"	"	"	"	"	U
Benzo(b)fluoranthene	**0.0122**	0.0271	"	"	"	"	"	J
Benzo(ghi)perylene	**0.00678**	0.0271	"	"	"	"	"	J
Benzo(k)fluoranthene	ND	0.0271	"	"	"	"	"	U
Chrysene	**0.0244**	0.0271	"	"	"	"	"	J
Dibenzo(a,h)anthracene	ND	0.0271	"	"	"	"	"	U
Fluoranthene	**0.0258**	0.0271	"	"	"	"	"	J
Fluorene	ND	0.0271	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.0271	"	"	"	"	"	U
Naphthalene	ND	0.0271	"	"	"	"	"	U
Phenanthrene	**0.0312**	0.0271	"	"	"	"	"	

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS02 (0-5)
4/27/2016 2:20:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X604294-01 (Soil)								
PAH by 8270D SIM								
Pyrene	**0.0366**	0.0271	mg/kg	4	1563766	05/02/2016	05/02/2016	
Surrogate: 5-alpha-Androstane	*49 %*	*25-129*			"	"	"	
Total Metals by 6010C								
Arsenic	**3.96**	2.91	mg/kg	1	1563659	04/30/2016	05/02/2016	
Barium	**174**	0.485	"	"	"	"	"	
Cadmium	ND	0.485	"	"	"	"	"	U
Chromium	**11.1**	0.485	"	"	"	"	"	
Lead	**15.1**	0.970	"	"	"	"	"	
Selenium	**0.686**	2.91	"	"	"	"	"	J
Silver	**0.122**	0.485	"	"	"	"	"	J
Total Metals by 7471A								
Mercury	ND	0.0114	mg/kg	1	1563868	05/02/2016	05/03/2016	U
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
1,1,1-Trichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.0020	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS02 (0-5)
4/27/2016 2:20:00PM

Origins Laboratory, Inc.

X604294-01 (Soil)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1-Dichloroethane	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
1,1-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.0050	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.0050	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.0050	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.0020	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.0050	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.0020	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.0020	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS02 (0-5)
4/27/2016 2:20:00PM

Origins Laboratory, Inc.

X604294-01 (Soil)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Hexanone	ND	0.0100	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
4-Chlorotoluene	ND	0.0020	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.0020	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.0020	"	"	"	"	"	Ua
Bromobenzene	ND	0.0020	"	"	"	"	"	Ua
Bromochloromethane	ND	0.0020	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.0020	"	"	"	"	"	Ua
Bromoform	ND	0.0020	"	"	"	"	"	Ua
Bromomethane	ND	0.0020	"	"	"	"	"	Ua
Carbon disulfide	ND	0.0050	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.0020	"	"	"	"	"	Ua
Chlorobenzene	ND	0.0020	"	"	"	"	"	Ua
Chloroethane	ND	0.0050	"	"	"	"	"	Ua
Chloroform	ND	0.0020	"	"	"	"	"	Ua
Chloromethane	ND	0.0020	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS02 (0-5)
4/27/2016 2:20:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X604294-01 (Soil)

VOC by EPA 8260C

Dibromochloromethane	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
Dibromomethane	ND	0.0020	"	"	"	"	"	Ua
Ethylbenzene	ND	0.0020	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.0050	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.0020	"	"	"	"	"	Ua
m,p-Xylene	ND	0.0040	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.0020	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.0020	"	"	"	"	"	Ua
o-Xylene	ND	0.0020	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
Styrene	ND	0.0020	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.0020	"	"	"	"	"	Ua
Toluene	ND	0.0020	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS02 (0-5)
4/27/2016 2:20:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X604294-01 (Soil)

VOC by EPA 8260C

trans-1,3-Dichloropropene	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
Trichloroethene	ND	0.0020	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	0.0030	"	"	"	"	"	Ua
Vinyl chloride	ND	0.0020	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*109 %*	*70-130*			"	"	"	
Surrogate: Toluene-d8	*98.2 %*	*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*106 %*	*70-130*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS01 (0-5)
4/27/2016 4:05:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.								
X604294-02 (Soil)								
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	50.0	mg/kg	1	B6D2907	04/29/2016	05/05/2016	Ua
Diesel (C10-C28)	**123**	50.0	"	"	"	"	"	
Surrogate: o-Terphenyl	*91.4 %*	*59-131*			"	"	"	
PAH by 8270D SIM								
Acenaphthene	ND	0.0306	mg/kg	4	1563766	05/02/2016	05/02/2016	U
Acenaphthylene	ND	0.0306	"	"	"	"	"	U
Anthracene	**0.00917**	0.0306	"	"	"	"	"	J
Benzo(a)anthracene	**0.0138**	0.0306	"	"	"	"	"	J
Benzo(a)pyrene	**0.00917**	0.0306	"	"	"	"	"	J
Benzo(b)fluoranthene	**0.0199**	0.0306	"	"	"	"	"	J
Benzo(ghi)perylene	**0.0122**	0.0306	"	"	"	"	"	J
Benzo(k)fluoranthene	ND	0.0306	"	"	"	"	"	U
Chrysene	**0.0351**	0.0306	"	"	"	"	"	
Dibenzo(a,h)anthracene	ND	0.0306	"	"	"	"	"	U
Fluoranthene	**0.0351**	0.0306	"	"	"	"	"	
Fluorene	**0.00917**	0.0306	"	"	"	"	"	J
Indeno(1,2,3-cd)pyrene	ND	0.0306	"	"	"	"	"	U
Naphthalene	**0.0351**	0.0306	"	"	"	"	"	
Phenanthrene	**0.0825**	0.0306	"	"	"	"	"	
Pyrene	**0.0611**	0.0306	"	"	"	"	"	

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS01 (0-5)
4/27/2016 4:05:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X604294-02 (Soil)								
PAH by 8270D SIM								
Surrogate: 5-alpha-Androstane	*44 %*	*25-129*			*1563766*	*05/02/2016*	*05/02/2016*	
Total Metals by 6010C								
Arsenic	**4.05**	3.44	mg/kg	1	1563659	04/30/2016	05/02/2016	
Barium	**196**	0.574	"	"	"	"	"	
Cadmium	ND	0.574	"	"	"	"	"	U
Chromium	**12.4**	0.574	"	"	"	"	"	
Lead	**10.2**	1.15	"	"	"	"	"	
Selenium	**0.585**	3.44	"	"	"	"	"	J
Silver	**0.330**	0.574	"	"	"	"	"	J
Total Metals by 7471A								
Mercury	**0.0052**	0.0125	mg/kg	1	1563868	05/02/2016	05/03/2016	J
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
1,1,1-Trichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.0020	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS01 (0-5)
4/27/2016 4:05:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X604294-02 (Soil)

VOC by EPA 8260C

1,1-Dichloroethene	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
1,1-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.0050	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.0050	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.0050	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.0020	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.0050	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.0020	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.0020	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS01 (0-5)
4/27/2016 4:05:00PM

Origins Laboratory, Inc.

X604294-02 (Soil)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
4-Chlorotoluene	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
4-Isopropyltoluene	ND	0.0020	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.0020	"	"	"	"	"	Ua
Bromobenzene	ND	0.0020	"	"	"	"	"	Ua
Bromochloromethane	ND	0.0020	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.0020	"	"	"	"	"	Ua
Bromoform	ND	0.0020	"	"	"	"	"	Ua
Bromomethane	ND	0.0020	"	"	"	"	"	Ua
Carbon disulfide	ND	0.0050	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.0020	"	"	"	"	"	Ua
Chlorobenzene	ND	0.0020	"	"	"	"	"	Ua
Chloroethane	ND	0.0050	"	"	"	"	"	Ua
Chloroform	ND	0.0020	"	"	"	"	"	Ua
Chloromethane	ND	0.0020	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.0020	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS01 (0-5)
4/27/2016 4:05:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X604294-02 (Soil)

VOC by EPA 8260C

Dibromomethane	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
Ethylbenzene	ND	0.0020	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.0050	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.0020	"	"	"	"	"	Ua
m,p-Xylene	ND	0.0040	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.0020	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.0020	"	"	"	"	"	Ua
o-Xylene	ND	0.0020	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
Styrene	ND	0.0020	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.0020	"	"	"	"	"	Ua
Toluene	ND	0.0020	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW14SS01 (0-5)
4/27/2016 4:05:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.								
X604294-02 (Soil)								
VOC by EPA 8260C								
Trichloroethene	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
Trichlorofluoromethane	ND	0.0030	"	"	"	"	"	Ua
Vinyl chloride	ND	0.0020	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*119 %*	*70-130*			"	"	"	
Surrogate: Toluene-d8	*98.3 %*	*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*104 %*	*70-130*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW31SS01 (0-5)
4/27/2016 12:07:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.								
X604294-03 (Soil)								
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	50.0	mg/kg	1	B6D2907	04/29/2016	05/05/2016	Ua
Diesel (C10-C28)	**92.5**	50.0	"	"	"	"	"	
Surrogate: o-Terphenyl	*72.9 %*	*59-131*			"	"	"	
PAH by 8270D SIM								
Acenaphthene	**0.0103**	0.0293	mg/kg	4	1563766	05/02/2016	05/02/2016	J
Acenaphthylene	ND	0.0293	"	"	"	"	"	U
Anthracene	**0.019**	0.0293	"	"	"	"	"	J
Benzo(a)anthracene	**0.0718**	0.0293	"	"	"	"	"	
Benzo(a)pyrene	**0.0542**	0.0293	"	"	"	"	"	
Benzo(b)fluoranthene	**0.085**	0.0293	"	"	"	"	"	
Benzo(ghi)perylene	ND	0.0293	"	"	"	"	"	U
Benzo(k)fluoranthene	**0.0322**	0.0293	"	"	"	"	"	
Chrysene	**0.104**	0.0293	"	"	"	"	"	
Dibenzo(a,h)anthracene	ND	0.0293	"	"	"	"	"	U
Fluoranthene	**0.127**	0.0293	"	"	"	"	"	
Fluorene	ND	0.0293	"	"	"	"	"	U
Indeno(1,2,3-cd)pyrene	ND	0.0293	"	"	"	"	"	U
Naphthalene	**0.00879**	0.0293	"	"	"	"	"	J
Phenanthrene	**0.149**	0.0293	"	"	"	"	"	
Pyrene	**0.186**	0.0293	"	"	"	"	"	

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW31SS01 (0-5)
4/27/2016 12:07:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X604294-03 (Soil)								
PAH by 8270D SIM								
Surrogate: 5-alpha-Androstane	*38 %*	*25-129*			*1563766*	*05/02/2016*	*05/02/2016*	
TCLP Metals by 6010C								
Lead	**3.23**	0.100	mg/L	1	1566351	05/11/2016	05/11/2016	
Total Metals by 6010C								
Arsenic	**10.1**	3.08	mg/kg	1	1563659	04/30/2016	05/02/2016	
Barium	**736**	0.513	"	"	"	"	"	
Cadmium	**0.477**	0.513	"	"	"	"	"	J
Chromium	**9.28**	0.513	"	"	"	"	"	
Copper	**238**	1.03	"	"	"	"	"	
Lead	**1620**	1.03	"	"	"	"	"	
Selenium	**1.80**	3.08	"	"	"	"	"	J
Silver	**4.44**	0.513	"	"	"	"	"	
Total Metals by 7196A								
Hexavalent Chromium	**2.50**	4.39	mg/kg	10	1563760	04/29/2016	05/03/2016	J
Total Metals by 7471A								
Mercury	**0.0863**	0.0111	mg/kg	1	1563868	05/02/2016	05/03/2016	

Origins Laboratory, Inc.

Jen Pellegrini

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW31SS01 (0-5)
4/27/2016 12:07:00PM

GEL Laboratories, LLC

X604294-03 (Soil)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,1,2-Tetrachloroethane	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
1,1,1-Trichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.0050	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.0050	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.0050	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.0020	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.0050	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.0020	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.0020	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.0020	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua

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RW31SS01 (0-5)
4/27/2016 12:07:00PM

Origins Laboratory, Inc.

X604294-03 (Soil)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,4-Dichlorobenzene	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
2,2-Dichloropropane	ND	0.0020	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.0020	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.0020	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.0020	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.0020	"	"	"	"	"	Ua
Bromobenzene	ND	0.0020	"	"	"	"	"	Ua
Bromochloromethane	ND	0.0020	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.0020	"	"	"	"	"	Ua
Bromoform	ND	0.0020	"	"	"	"	"	Ua
Bromomethane	ND	0.0020	"	"	"	"	"	Ua
Carbon disulfide	ND	0.0050	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.0020	"	"	"	"	"	Ua
Chlorobenzene	ND	0.0020	"	"	"	"	"	Ua
Chloroethane	ND	0.0050	"	"	"	"	"	Ua

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW31SS01 (0-5)
4/27/2016 12:07:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X604294-03 (Soil)

VOC by EPA 8260C

Chloroform	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
Chloromethane	ND	0.0020	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.0020	"	"	"	"	"	Ua
Dibromomethane	ND	0.0020	"	"	"	"	"	Ua
Ethylbenzene	ND	0.0020	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.0050	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.0020	"	"	"	"	"	Ua
m,p-Xylene	ND	0.0040	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.0020	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.0020	"	"	"	"	"	Ua
o-Xylene	ND	0.0020	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.0020	"	"	"	"	"	Ua
Styrene	ND	0.0020	"	"	"	"	"	Ua

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

RW31SS01 (0-5)
4/27/2016 12:07:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X604294-03 (Soil)

VOC by EPA 8260C

tert-Butylbenzene	ND	0.0020	mg/kg	1	B6D2901	04/29/2016	05/03/2016	Ua
Tetrachloroethene	ND	0.0020	"	"	"	"	"	Ua
Toluene	ND	0.0020	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.0020	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.0020	"	"	"	"	"	Ua
Trichloroethene	ND	0.0020	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	0.0030	"	"	"	"	"	Ua
Vinyl chloride	ND	0.0020	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*106 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*98.3 %*	*70-130*	"	"	"
Surrogate: 4-Bromofluorobenzene	*102 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Blank (B6D2901-BLK1)					Prepared: 04/28/2016 Analyzed: 04/29/2016					
1,1,1,2-Tetrachloroethane	ND	0.0020	mg/kg							Ua
1,1,1-Trichloroethane	ND	0.0020	"							Ua
1,1,2,2-Tetrachloroethane	ND	0.0020	"							Ua
1,1,2-Trichloroethane	ND	0.0020	"							Ua
1,1-Dichloroethane	ND	0.0020	"							Ua
1,1-Dichloroethene	ND	0.0020	"							Ua
1,1-Dichloropropene	ND	0.0020	"							Ua
1,2,3-Trichlorobenzene	ND	0.0050	"							Ua
1,2,3-Trichloropropane	ND	0.0050	"							Ua
1,2,4-Trichlorobenzene	ND	0.0050	"							Ua
1,2,4-Trimethylbenzene	ND	0.0020	"							Ua
1,2-Dibromo-3-chloropropane	ND	0.0050	"							Ua
1,2-Dibromoethane (EDB)	ND	0.0020	"							Ua
1,2-Dichlorobenzene	ND	0.0020	"							Ua
1,2-Dichloroethane	ND	0.0020	"							Ua
1,2-Dichloropropane	ND	0.0020	"							Ua
1,3,5-Trimethylbenzene	ND	0.0020	"							Ua
1,3-Dichlorobenzene	ND	0.0020	"							Ua
1,3-Dichloropropane	ND	0.0020	"							Ua
1,4-Dichlorobenzene	ND	0.0020	"							Ua
2,2-Dichloropropane	ND	0.0020	"							Ua
2-Butanone	ND	0.0100	"							Ua
2-Chlorotoluene	ND	0.0020	"							Ua
2-Hexanone	ND	0.0100	"							Ua
4-Chlorotoluene	ND	0.0020	"							Ua
4-Isopropyltoluene	ND	0.0020	"							Ua

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Blank (B6D2901-BLK1)					Prepared: 04/28/2016 Analyzed: 04/29/2016					
4-Methyl-2-pentanone	ND	0.0100	mg/kg							Ua
Acetone	ND	0.0200	"							Ua
Benzene	ND	0.0020	"							Ua
Bromobenzene	ND	0.0020	"							Ua
Bromochloromethane	ND	0.0020	"							Ua
Bromodichloromethane	ND	0.0020	"							Ua
Bromoform	ND	0.0020	"							Ua
Bromomethane	ND	0.0020	"							Ua
Carbon disulfide	ND	0.0050	"							Ua
Carbon tetrachloride	ND	0.0020	"							Ua
Chlorobenzene	ND	0.0020	"							Ua
Chloroethane	ND	0.0050	"							Ua
Chloroform	ND	0.0020	"							Ua
Chloromethane	ND	0.0020	"							Ua
cis-1,2-Dichloroethene	ND	0.0020	"							Ua
cis-1,3-Dichloropropene	ND	0.0020	"							Ua
Dibromochloromethane	ND	0.0020	"							Ua
Dibromomethane	ND	0.0020	"							Ua
Ethylbenzene	ND	0.0020	"							Ua
Hexachlorobutadiene	ND	0.0050	"							Ua
Iodomethane	ND	0.0150	"							Ua
Isopropylbenzene	ND	0.0020	"							Ua
m,p-Xylene	ND	0.0040	"							Ua
Methyl tert-Butyl Ether	ND	0.0020	"							Ua
Methylene Chloride	ND	0.0200	"							Ua
Naphthalene	ND	0.0100	"							Ua

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Blank (B6D2901-BLK1)					Prepared: 04/28/2016 Analyzed: 04/29/2016					
n-Butylbenzene	ND	0.0020	mg/kg							Ua
n-Propylbenzene	ND	0.0020	"							Ua
o-Xylene	ND	0.0020	"							Ua
sec-Butylbenzene	ND	0.0020	"							Ua
Styrene	ND	0.0020	"							Ua
tert-Butylbenzene	ND	0.0020	"							Ua
Tetrachloroethene	ND	0.0020	"							Ua
Toluene	ND	0.0020	"							Ua
trans-1,2-Dichloroethene	ND	0.0020	"							Ua
trans-1,3-Dichloropropene	ND	0.0020	"							Ua
Trichloroethene	ND	0.0020	"							Ua
Trichlorofluoromethane	ND	0.0030	"							Ua
Vinyl chloride	ND	0.0020	"							Ua
Surrogate: 1,2-Dichloroethane-d4	*65*		*ug/L*	*62.5*		*104*	*70-130*			
Surrogate: Toluene-d8	*61*		*"*	*62.5*		*96.8*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*63*		*"*	*62.5*		*100*	*70-130*			

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Project: Federal Phase II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
LCS (B6D2901-BS1)					Prepared: 04/28/2016 Analyzed: 04/29/2016					
1,1,1,2-Tetrachloroethane	0.0863	0.0020	mg/kg	0.100		86.3	70-130			
1,1,1-Trichloroethane	0.0875	0.0020	"	0.100		87.5	70-130			
1,1,2,2-Tetrachloroethane	0.0835	0.0020	"	0.100		83.5	70-130			
1,1,2-Trichloroethane	0.0831	0.0020	"	0.100		83.1	70-130			
1,1-Dichloroethane	0.0855	0.0020	"	0.100		85.5	70-130			
1,1-Dichloroethene	0.0880	0.0020	"	0.100		88.0	70-130			
1,1-Dichloropropene	0.0847	0.0020	"	0.100		84.7	70-130			
1,2,3-Trichlorobenzene	0.0802	0.0050	"	0.100		80.2	70-130			
1,2,3-Trichloropropane	0.0914	0.0050	"	0.100		91.4	70-130			
1,2,4-Trichlorobenzene	0.0767	0.0050	"	0.100		76.7	70-130			
1,2,4-Trimethylbenzene	0.0838	0.0020	"	0.100		83.8	70-130			
1,2-Dibromo-3-chloropropane	0.0991	0.0050	"	0.100		99.1	70-130			
1,2-Dibromoethane (EDB)	0.0838	0.0020	"	0.100		83.8	70-130			
1,2-Dichlorobenzene	0.0830	0.0020	"	0.100		83.0	70-130			
1,2-Dichloroethane	0.0995	0.0020	"	0.100		99.5	70-130			
1,2-Dichloropropane	0.102	0.0020	"	0.100		102	70-130			
1,3,5-Trimethylbenzene	0.0841	0.0020	"	0.100		84.1	70-130			
1,3-Dichlorobenzene	0.0814	0.0020	"	0.100		81.4	70-130			
1,3-Dichloropropane	0.0831	0.0020	"	0.100		83.1	70-130			
1,4-Dichlorobenzene	0.0812	0.0020	"	0.100		81.2	70-130			
2,2-Dichloropropane	0.0901	0.0020	"	0.100		90.1	70-130			
2-Butanone	0.438	0.0100	"	0.500		87.7	70-130			
2-Chlorotoluene	0.0836	0.0020	"	0.100		83.6	70-130			
2-Hexanone	0.448	0.0100	"	0.500		89.7	70-130			
4-Chlorotoluene	0.0835	0.0020	"	0.100		83.5	70-130			
4-Isopropyltoluene	0.0832	0.0020	"	0.100		83.2	70-130			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
LCS (B6D2901-BS1)					Prepared: 04/28/2016 Analyzed: 04/29/2016					
4-Methyl-2-pentanone	0.448	0.0100	mg/kg	0.500		89.7	70-130			
Acetone	0.465	0.0200	"	0.500		93.0	70-130			
Benzene	0.0836	0.0020	"	0.100		83.6	70-130			
Bromobenzene	0.0855	0.0020	"	0.100		85.5	70-130			
Bromochloromethane	0.0828	0.0020	"	0.100		82.8	70-130			
Bromodichloromethane	0.0861	0.0020	"	0.100		86.1	70-130			
Bromoform	0.0918	0.0020	"	0.100		91.8	70-130			
Bromomethane	0.0953	0.0020	"	0.100		95.3	70-130			
Carbon disulfide	0.0849	0.0050	"	0.100		84.9	70-130			
Carbon tetrachloride	0.0874	0.0020	"	0.100		87.4	70-130			
Chlorobenzene	0.0837	0.0020	"	0.100		83.7	70-130			
Chloroethane	0.101	0.0050	"	0.100		101	70-130			
Chloroform	0.0836	0.0020	"	0.100		83.6	70-130			
Chloromethane	0.0878	0.0020	"	0.100		87.8	70-130			
cis-1,2-Dichloroethene	0.0845	0.0020	"	0.100		84.5	70-130			
cis-1,3-Dichloropropene	0.0841	0.0020	"	0.100		84.1	70-130			
Dibromochloromethane	0.0906	0.0020	"	0.100		90.6	70-130			
Dibromomethane	0.0810	0.0020	"	0.100		81.0	70-130			
Ethylbenzene	0.104	0.0020	"	0.100		104	70-130			
Hexachlorobutadiene	0.0832	0.0050	"	0.100		83.2	70-130			
Iodomethane	0.0866	0.0150	"	0.100		86.6	70-130			
Isopropylbenzene	0.103	0.0020	"	0.100		103	70-130			
m,p-Xylene	0.212	0.0040	"	0.200		106	70-130			
Methyl tert-Butyl Ether	0.0932	0.0020	"	0.100		93.2	70-130			
Methylene Chloride	0.0956	0.0200	"	0.100		95.6	70-130			
Naphthalene	0.0937	0.0100	"	0.100		93.7	70-130			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
LCS (B6D2901-BS1)					Prepared: 04/28/2016 Analyzed: 04/29/2016					
n-Butylbenzene	0.103	0.0020	mg/kg	0.100		103	70-130			
n-Propylbenzene	0.103	0.0020	"	0.100		103	70-130			
o-Xylene	0.102	0.0020	"	0.100		102	70-130			
sec-Butylbenzene	0.104	0.0020	"	0.100		104	70-130			
Styrene	0.0852	0.0020	"	0.100		85.2	70-130			
tert-Butylbenzene	0.0861	0.0020	"	0.100		86.1	70-130			
Tetrachloroethene	0.0966	0.0020	"	0.100		96.6	70-130			
Toluene	0.0997	0.0020	"	0.100		99.7	70-130			
trans-1,2-Dichloroethene	0.0863	0.0020	"	0.100		86.3	70-130			
trans-1,3-Dichloropropene	0.0841	0.0020	"	0.100		84.1	70-130			
Trichloroethene	0.0987	0.0020	"	0.100		98.7	70-130			
Trichlorofluoromethane	0.0970	0.0030	"	0.100		97.0	70-130			
Vinyl chloride	0.100	0.0020	"	0.100		100	70-130			
Surrogate: 1,2-Dichloroethane-d4	*66*		*ug/L*	*62.5*		*105*	*70-130*			
Surrogate: Toluene-d8	*62*		*"*	*62.5*		*99.7*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*62*		*"*	*62.5*		*99.7*	*70-130*			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Matrix Spike (B6D2901-MS1)		**Source: X604256-01**			Prepared: 04/29/2016 Analyzed: 04/29/2016					
1,1,1,2-Tetrachloroethane	0.179	0.0020	mg/kg	0.200	ND	89.4	70-130			
1,1,1-Trichloroethane	0.172	0.0020	"	0.200	ND	85.9	70-130			
1,1,2,2-Tetrachloroethane	0.0056	0.0020	"	0.200	ND	2.81	70-130			QM-07
1,1,2-Trichloroethane	0.185	0.0020	"	0.200	ND	92.6	70-130			
1,1-Dichloroethane	0.179	0.0020	"	0.200	ND	89.4	70-130			
1,1-Dichloroethene	0.183	0.0020	"	0.200	ND	91.6	70-130			
1,1-Dichloropropene	0.163	0.0020	"	0.200	ND	81.6	70-130			
1,2,3-Trichlorobenzene	0.124	0.0050	"	0.200	ND	61.9	70-130			QM-07
1,2,3-Trichloropropane	0.217	0.0050	"	0.200	ND	109	70-130			
1,2,4-Trichlorobenzene	0.121	0.0050	"	0.200	0.0006	60.0	70-130			QM-07
1,2,4-Trimethylbenzene	0.150	0.0020	"	0.200	0.0009	74.7	70-130			
1,2-Dibromo-3-chloropropane	0.210	0.0050	"	0.200	ND	105	70-130			
1,2-Dibromoethane (EDB)	0.190	0.0020	"	0.200	ND	95.0	70-130			
1,2-Dichlorobenzene	0.152	0.0020	"	0.200	ND	75.8	70-130			
1,2-Dichloroethane	0.221	0.0020	"	0.200	ND	111	70-130			
1,2-Dichloropropane	0.226	0.0020	"	0.200	ND	113	70-130			
1,3,5-Trimethylbenzene	0.146	0.0020	"	0.200	0.0004	72.7	70-130			
1,3-Dichlorobenzene	0.143	0.0020	"	0.200	ND	71.3	70-130			
1,3-Dichloropropane	0.191	0.0020	"	0.200	ND	95.7	70-130			
1,4-Dichlorobenzene	0.146	0.0020	"	0.200	ND	73.0	70-130			
2,2-Dichloropropane	0.198	0.0020	"	0.200	ND	99.1	70-130			
2-Butanone	1.10	0.0100	"	1.00	ND	110	70-130			
2-Chlorotoluene	0.148	0.0020	"	0.200	ND	73.9	70-130			
2-Hexanone	1.12	0.0100	"	1.00	ND	112	70-130			
4-Chlorotoluene	0.150	0.0020	"	0.200	ND	75.2	70-130			
4-Isopropyltoluene	0.129	0.0020	"	0.200	ND	64.7	70-130			QM-07

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Matrix Spike (B6D2901-MS1)		**Source: X604256-01**			Prepared: 04/29/2016 Analyzed: 04/29/2016					
4-Methyl-2-pentanone	1.12	0.0100	mg/kg	1.00	ND	112	70-130			
Acetone	1.49	0.0200	"	1.00	0.102	139	70-130			QM-07
Benzene	0.171	0.0020	"	0.200	ND	85.7	70-130			
Bromobenzene	0.170	0.0020	"	0.200	ND	85.1	70-130			
Bromochloromethane	0.182	0.0020	"	0.200	ND	91.0	70-130			
Bromodichloromethane	0.185	0.0020	"	0.200	ND	92.3	70-130			
Bromoform	0.214	0.0020	"	0.200	ND	107	70-130			
Bromomethane	0.192	0.0020	"	0.200	ND	96.0	70-130			
Carbon disulfide	0.127	0.0050	"	0.200	ND	63.6	70-130			QM-07
Carbon tetrachloride	0.166	0.0020	"	0.200	ND	83.0	70-130			
Chlorobenzene	0.159	0.0020	"	0.200	ND	79.3	70-130			
Chloroethane	0.202	0.0050	"	0.200	ND	101	70-130			
Chloroform	0.176	0.0020	"	0.200	ND	88.2	70-130			
Chloromethane	0.175	0.0020	"	0.200	ND	87.5	70-130			
cis-1,2-Dichloroethene	0.175	0.0020	"	0.200	ND	87.3	70-130			
cis-1,3-Dichloropropene	0.183	0.0020	"	0.200	ND	91.3	70-130			
Dibromochloromethane	0.200	0.0020	"	0.200	ND	100	70-130			
Dibromomethane	0.184	0.0020	"	0.200	ND	92.0	70-130			
Ethylbenzene	0.200	0.0020	"	0.200	ND	100	70-130			
Hexachlorobutadiene	0.0860	0.0050	"	0.200	ND	43.0	70-130			QM-07
Iodomethane	0.127	0.0150	"	0.200	ND	63.5	70-130			QM-07
Isopropylbenzene	0.188	0.0020	"	0.200	ND	94.0	70-130			
m,p-Xylene	0.410	0.0040	"	0.400	ND	103	70-130			
Methyl tert-Butyl Ether	0.218	0.0020	"	0.200	ND	109	70-130			
Methylene Chloride	0.253	0.0200	"	0.200	0.0183	117	70-130			
Naphthalene	0.161	0.0100	"	0.200	ND	80.6	70-130			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Matrix Spike (B6D2901-MS1)		**Source: X604256-01**			Prepared: 04/29/2016 Analyzed: 04/29/2016					
n-Butylbenzene	0.161	0.0020	mg/kg	0.200	ND	80.6	70-130			
n-Propylbenzene	0.184	0.0020	"	0.200	ND	91.9	70-130			
o-Xylene	0.202	0.0020	"	0.200	ND	101	70-130			
sec-Butylbenzene	0.164	0.0020	"	0.200	ND	82.2	70-130			
Styrene	0.163	0.0020	"	0.200	ND	81.4	70-130			
tert-Butylbenzene	0.145	0.0020	"	0.200	ND	72.6	70-130			
Tetrachloroethene	0.177	0.0020	"	0.200	ND	88.6	70-130			
Toluene	0.201	0.0020	"	0.200	ND	100	70-130			
trans-1,2-Dichloroethene	0.174	0.0020	"	0.200	ND	87.0	70-130			
trans-1,3-Dichloropropene	0.183	0.0020	"	0.200	ND	91.3	70-130			
Trichloroethene	0.329	0.0020	"	0.200	ND	164	70-130			QM-07
Trichlorofluoromethane	0.185	0.0030	"	0.200	ND	92.5	70-130			
Vinyl chloride	0.189	0.0020	"	0.200	ND	94.4	70-130			
Surrogate: 1,2-Dichloroethane-d4	*70*		*ug/L*	*62.5*		*111*	*70-130*			
Surrogate: Toluene-d8	*63*		*"*	*62.5*		*100*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*65*		*"*	*62.5*		*103*	*70-130*			

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Matrix Spike Dup (B6D2901-MSD1)		**Source: X604256-01**			Prepared: 04/29/2016 Analyzed: 04/29/2016					
1,1,1,2-Tetrachloroethane	0.157	0.0020	mg/kg	0.200	ND	78.5	70-130	13.0	20	
1,1,1-Trichloroethane	0.162	0.0020	"	0.200	ND	80.8	70-130	6.17	20	
1,1,2,2-Tetrachloroethane	0.0044	0.0020	"	0.200	ND	2.18	70-130	25.3	20	QM-07
1,1,2-Trichloroethane	0.158	0.0020	"	0.200	ND	79.0	70-130	15.9	20	
1,1-Dichloroethane	0.164	0.0020	"	0.200	ND	82.0	70-130	8.64	20	
1,1-Dichloroethene	0.171	0.0020	"	0.200	ND	85.4	70-130	6.92	20	
1,1-Dichloropropene	0.152	0.0020	"	0.200	ND	76.2	70-130	6.92	20	
1,2,3-Trichlorobenzene	0.119	0.0050	"	0.200	ND	59.5	70-130	3.94	20	QM-07
1,2,3-Trichloropropane	0.187	0.0050	"	0.200	ND	93.3	70-130	15.3	20	
1,2,4-Trichlorobenzene	0.109	0.0050	"	0.200	0.0006	53.9	70-130	10.5	20	QM-07
1,2,4-Trimethylbenzene	0.136	0.0020	"	0.200	0.0009	67.8	70-130	9.67	20	QM-07
1,2-Dibromo-3-chloropropane	0.185	0.0050	"	0.200	ND	92.7	70-130	12.7	20	
1,2-Dibromoethane (EDB)	0.173	0.0020	"	0.200	ND	86.6	70-130	9.21	20	
1,2-Dichlorobenzene	0.137	0.0020	"	0.200	ND	68.6	70-130	10.0	20	QM-07
1,2-Dichloroethane	0.203	0.0020	"	0.200	ND	102	70-130	8.65	20	
1,2-Dichloropropane	0.208	0.0020	"	0.200	ND	104	70-130	8.45	20	
1,3,5-Trimethylbenzene	0.133	0.0020	"	0.200	0.0004	66.4	70-130	9.03	20	QM-07
1,3-Dichlorobenzene	0.129	0.0020	"	0.200	ND	64.4	70-130	10.2	20	QM-07
1,3-Dichloropropane	0.173	0.0020	"	0.200	ND	86.7	70-130	9.89	20	
1,4-Dichlorobenzene	0.132	0.0020	"	0.200	ND	66.1	70-130	9.94	20	QM-07
2,2-Dichloropropane	0.184	0.0020	"	0.200	ND	91.9	70-130	7.55	20	
2-Butanone	0.978	0.0100	"	1.00	ND	97.8	70-130	12.1	20	
2-Chlorotoluene	0.134	0.0020	"	0.200	ND	67.1	70-130	9.63	20	QM-07
2-Hexanone	0.966	0.0100	"	1.00	ND	96.6	70-130	15.1	20	
4-Chlorotoluene	0.136	0.0020	"	0.200	ND	68.0	70-130	10.1	20	QM-07
4-Isopropyltoluene	0.118	0.0020	"	0.200	ND	59.0	70-130	9.20	20	QM-07

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Matrix Spike Dup (B6D2901-MSD1)		**Source: X604256-01**			Prepared: 04/29/2016 Analyzed: 04/29/2016					
4-Methyl-2-pentanone	0.966	0.0100	mg/kg	1.00	ND	96.6	70-130	15.1	20	
Acetone	1.28	0.0200	"	1.00	0.102	118	70-130	15.0	20	
Benzene	0.159	0.0020	"	0.200	ND	79.4	70-130	7.68	20	
Bromobenzene	0.151	0.0020	"	0.200	ND	75.4	70-130	12.1	20	
Bromochloromethane	0.166	0.0020	"	0.200	ND	82.9	70-130	9.34	20	
Bromodichloromethane	0.167	0.0020	"	0.200	ND	83.5	70-130	10.0	20	
Bromoform	0.185	0.0020	"	0.200	ND	92.4	70-130	14.4	20	
Bromomethane	0.175	0.0020	"	0.200	ND	87.7	70-130	9.08	20	
Carbon disulfide	0.124	0.0050	"	0.200	ND	61.8	70-130	2.89	20	QM-07
Carbon tetrachloride	0.155	0.0020	"	0.200	ND	77.5	70-130	6.87	20	
Chlorobenzene	0.147	0.0020	"	0.200	ND	73.4	70-130	7.69	20	
Chloroethane	0.183	0.0050	"	0.200	ND	91.6	70-130	9.85	20	
Chloroform	0.162	0.0020	"	0.200	ND	81.2	70-130	8.27	20	
Chloromethane	0.160	0.0020	"	0.200	ND	79.9	70-130	9.04	20	
cis-1,2-Dichloroethene	0.162	0.0020	"	0.200	ND	80.9	70-130	7.62	20	
cis-1,3-Dichloropropene	0.168	0.0020	"	0.200	ND	84.0	70-130	8.28	20	
Dibromochloromethane	0.178	0.0020	"	0.200	ND	88.9	70-130	12.0	20	
Dibromomethane	0.166	0.0020	"	0.200	ND	82.9	70-130	10.5	20	
Ethylbenzene	0.181	0.0020	"	0.200	ND	90.7	70-130	10.0	20	
Hexachlorobutadiene	0.0756	0.0050	"	0.200	ND	37.8	70-130	12.9	20	QM-07
Iodomethane	0.120	0.0150	"	0.200	ND	60.0	70-130	5.65	20	QM-07
Isopropylbenzene	0.173	0.0020	"	0.200	ND	86.3	70-130	8.61	20	
m,p-Xylene	0.373	0.0040	"	0.400	ND	93.4	70-130	9.36	20	
Methyl tert-Butyl Ether	0.201	0.0020	"	0.200	ND	100	70-130	8.18	20	
Methylene Chloride	0.228	0.0200	"	0.200	0.0183	105	70-130	10.3	20	
Naphthalene	0.148	0.0100	"	0.200	ND	74.1	70-130	8.36	20	

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Corinne Wardell
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Project: Federal Phase II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2901 - EPA 5030 (soil)										
Matrix Spike Dup (B6D2901-MSD1)		**Source: X604256-01**			Prepared: 04/29/2016 Analyzed: 04/29/2016					
n-Butylbenzene	0.146	0.0020	mg/kg	0.200	ND	73.2	70-130	9.68	20	
n-Propylbenzene	0.166	0.0020	"	0.200	ND	83.2	70-130	9.92	20	
o-Xylene	0.184	0.0020	"	0.200	ND	91.8	70-130	9.72	20	
sec-Butylbenzene	0.151	0.0020	"	0.200	ND	75.4	70-130	8.63	20	
Styrene	0.147	0.0020	"	0.200	ND	73.6	70-130	9.98	20	
tert-Butylbenzene	0.133	0.0020	"	0.200	ND	66.5	70-130	8.86	20	QM-07
Tetrachloroethene	0.169	0.0020	"	0.200	ND	84.3	70-130	4.95	20	
Toluene	0.188	0.0020	"	0.200	ND	93.8	70-130	6.79	20	
trans-1,2-Dichloroethene	0.160	0.0020	"	0.200	ND	80.2	70-130	8.23	20	
trans-1,3-Dichloropropene	0.168	0.0020	"	0.200	ND	84.0	70-130	8.28	20	
Trichloroethene	0.298	0.0020	"	0.200	ND	149	70-130	9.97	20	QM-07
Trichlorofluoromethane	0.173	0.0030	"	0.200	ND	86.4	70-130	6.82	20	
Vinyl chloride	0.179	0.0020	"	0.200	ND	89.6	70-130	5.28	20	
Surrogate: 1,2-Dichloroethane-d4	*69*		*ug/L*	*62.5*		*110*	*70-130*			
Surrogate: Toluene-d8	*63*		*"*	*62.5*		*101*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*64*		*"*	*62.5*		*102*	*70-130*			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6D2907 - EPA 3580										
Blank (B6D2907-BLK1)					Prepared: 04/29/2016 Analyzed: 05/02/2016					
Gasoline (C6-C10)	ND	50.0	mg/kg							Ua
Diesel (C10-C28)	ND	50.0	"							Ua
Surrogate: o-Terphenyl	*40*		"	*50.0*		*81.0*	*59-131*			
LCS (B6D2907-BS1)					Prepared: 04/29/2016 Analyzed: 05/02/2016					
Gasoline (C6-C10)	1090	50.0	mg/kg	1000		109	59-133			
Diesel (C10-C28)	996	50.0	"	1000		99.6	64-121			
Surrogate: o-Terphenyl	*50*		"	*50.0*		*99.9*	*59-131*			
LCS Dup (B6D2907-BSD1)					Prepared: 04/29/2016 Analyzed: 05/02/2016					
Gasoline (C6-C10)	951	50.0	mg/kg	1000		95.1	59-133	14.0	20	
Diesel (C10-C28)	864	50.0	"	1000		86.4	64-121	14.2	20	
Surrogate: o-Terphenyl	*41*		"	*50.0*		*82.6*	*59-131*			

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

TCLP Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1566351 - SW846 3010A										
MS (1203545619 S)		**Source: X604294-03**			Prepared: 05/11/2016 Analyzed: 05/11/2016					
Lead	8.16	0.100	mg/L	5.00	3.23	98.5	75-125			
TB (1203545620-BLK)					Prepared: 05/11/2016 Analyzed: 05/11/2016					
Lead	0.0575	0.100	mg/L				-			J
BLANK (1203546062-BLK)					Prepared: 05/11/2016 Analyzed: 05/11/2016					
Lead	0.0563	0.100	mg/L				-			J
LCS (1203546063-BKS)					Prepared: 05/11/2016 Analyzed: 05/11/2016					
Lead	4.99	0.100	mg/L	5.00		99.7	80-120			
DUP (1203546064 D)		**Source: X604294-03**			Prepared: 05/11/2016 Analyzed: 05/11/2016					
Lead	3.17	0.100	mg/L		3.23		0-20	1.93	20	

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

PAH by 8270D SIM - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1563766 - SW846 3541										
BLANK (1203539097-BLK)					Prepared: 05/02/2016 Analyzed: 05/02/2016					
Fluoranthene	ND	0.00666	mg/kg				-			U
Acenaphthene	ND	0.00666	"				-			U
Anthracene	ND	0.00666	"				-			U
Benzo(a)anthracene	ND	0.00666	"				-			U
Benzo(a)pyrene	ND	0.00666	"				-			U
Benzo(b)fluoranthene	ND	0.00666	"				-			U
Benzo(ghi)perylene	ND	0.00666	"				-			U
Benzo(k)fluoranthene	ND	0.00666	"				-			U
Dibenzo(a,h)anthracene	ND	0.00666	"				-			U
Fluorene	ND	0.00666	"				-			U
Indeno(1,2,3-cd)pyrene	ND	0.00666	"				-			U
Naphthalene	ND	0.00666	"				-			U
Phenanthrene	ND	0.00666	"				-			U
Pyrene	ND	0.00666	"				-			U
Chrysene	ND	0.00666	"				-			U
Acenaphthylene	ND	0.00666	"				-			U
Surrogate: 5-alpha-Androstane	*0.0903*		"	*0.167*		*54*	*25-129*			
LCS (1203539098-BKS)					Prepared: 05/02/2016 Analyzed: 05/02/2016					
Benzo(k)fluoranthene	0.184	0.00666	mg/kg	0.333		55	38-113			
Pyrene	0.225	0.00666	"	0.333		68	28-108			
Acenaphthene	0.253	0.00666	"	0.333		76	37-100			
Benzo(b)fluoranthene	0.190	0.00666	"	0.333		57	34-119			
Anthracene	0.243	0.00666	"	0.333		73	37-107			
Benzo(a)pyrene	0.192	0.00666	"	0.333		58	35-117			
Acenaphthylene	0.248	0.00666	"	0.333		75	34-109			
Benzo(ghi)perylene	0.188	0.00666	"	0.333		57	23-123			

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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

PAH by 8270D SIM - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1563766 - SW846 3541										
LCS (1203539098-BKS)					Prepared: 05/02/2016 Analyzed: 05/02/2016					
Chrysene	0.259	0.00666	mg/kg	0.333		78	36-104			
Dibenzo(a,h)anthracene	0.211	0.00666	"	0.333		63	29-133			
Fluoranthene	0.268	0.00666	"	0.333		80	39-113			
Fluorene	0.257	0.00666	"	0.333		77	36-109			
Indeno(1,2,3-cd)pyrene	0.200	0.00666	"	0.333		60	31-127			
Naphthalene	0.251	0.00666	"	0.333		75	38-101			
Phenanthrene	0.266	0.00666	"	0.333		80	37-100			
Benzo(a)anthracene	0.251	0.00666	"	0.333		76	36-108			
Surrogate: 5-alpha-Androstane	*0.0932*		"	*0.166*		*56*	*25-129*			
MS (1203539099 S)		**Source: X604294-02**			Prepared: 05/02/2016 Analyzed: 05/02/2016					
Benzo(a)anthracene	0.255	0.0309	mg/kg	0.386	0.0138	62	23-124			
Benzo(ghi)perylene	0.140	0.0309	"	0.386	0.0122	33	18-118			
Acenaphthylene	0.273	0.0309	"	0.386	<0.00772	71	19-116			
Dibenzo(a,h)anthracene	0.182	0.0309	"	0.386	<0.00772	47	12-132			
Acenaphthene	0.286	0.0309	"	0.386	<0.00772	74	18-115			
Anthracene	0.289	0.0309	"	0.386	0.00917	72	23-115			
Benzo(b)fluoranthene	0.207	0.0309	"	0.386	0.0199	48	20-134			
Chrysene	0.307	0.0309	"	0.386	0.0351	70	18-121			
Benzo(a)pyrene	0.185	0.0309	"	0.386	0.00917	46	20-130			
Fluoranthene	0.199	0.0309	"	0.386	0.0351	42	21-124			
Fluorene	0.293	0.0309	"	0.386	0.00917	74	21-118			
Indeno(1,2,3-cd)pyrene	0.159	0.0309	"	0.386	<0.00772	41	11-130			
Naphthalene	0.276	0.0309	"	0.386	0.0351	62	14-114			
Phenanthrene	0.347	0.0309	"	0.386	0.0825	69	24-106			
Pyrene	0.449	0.0309	"	0.386	0.0611	101	16-122			
Benzo(k)fluoranthene	0.204	0.0309	"	0.386	<0.00772	53	23-128			

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9100 West Jewell Avenue, Suite 200
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Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

PAH by 8270D SIM - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1563766 - SW846 3541										
MS (1203539099 S)		**Source: X604294-02**			Prepared: 05/02/2016 Analyzed: 05/02/2016					
Surrogate: 5-alpha-Androstane	*0.0741*		*mg/kg*	*0.193*	*0.0841*	*38*	*25-129*			
MSD (1203539100 SD)		**Source: X604294-02**			Prepared: 05/02/2016 Analyzed: 05/02/2016					
Benzo(k)fluoranthene	0.218	0.0309	mg/kg	0.386	<0.00773	56	23-128	7	30	
Benzo(ghi)perylene	0.121	0.0309	"	0.386	0.0122	28	18-118	15	30	
Benzo(b)fluoranthene	0.210	0.0309	"	0.386	0.0199	49	20-134	2	30	
Benzo(a)pyrene	0.199	0.0309	"	0.386	0.00917	49	20-130	7	30	
Benzo(a)anthracene	0.263	0.0309	"	0.386	0.0138	64	23-124	3	30	
Anthracene	0.300	0.0309	"	0.386	0.00917	75	23-115	4	30	
Pyrene	0.434	0.0309	"	0.386	0.0611	97	16-122	3	30	
Acenaphthene	0.298	0.0309	"	0.386	<0.00773	77	18-115	4	30	
Chrysene	0.305	0.0309	"	0.386	0.0351	70	18-121	1	30	
Dibenzo(a,h)anthracene	0.195	0.0309	"	0.386	<0.00773	50	12-132	7	30	
Fluoranthene	0.213	0.0309	"	0.386	0.0351	46	21-124	7	30	
Fluorene	0.305	0.0309	"	0.386	0.00917	76	21-118	4	30	
Indeno(1,2,3-cd)pyrene	0.128	0.0309	"	0.386	<0.00773	33	11-130	21	30	
Naphthalene	0.281	0.0309	"	0.386	0.0351	64	14-114	2	30	
Phenanthrene	0.337	0.0309	"	0.386	0.0825	66	24-106	3	30	
Acenaphthylene	0.289	0.0309	"	0.386	<0.00773	75	19-116	6	30	
Surrogate: 5-alpha-Androstane	*0.0773*		*"*	*0.193*	*0.0841*	*40*	*25-129*			

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1563659 - SW846 3050B										
BLANK (1203538867-BLK)					Prepared: 04/30/2016 Analyzed: 05/02/2016					
Lead	ND	0.988	mg/kg				-			U
Arsenic	ND	2.96	"				-			U
Barium	ND	0.494	"				-			U
Cadmium	ND	0.494	"				-			U
Copper	ND	0.988	"				-			U
Selenium	ND	2.96	"				-			U
Silver	ND	0.494	"				-			U
Chromium	ND	0.494	"				-			U
LCS (1203538868-BKS)					Prepared: 04/30/2016 Analyzed: 05/02/2016					
Chromium	44.6	0.465	mg/kg	46.5		96	80-120			
Arsenic	44.5	2.79	"	46.5		95.7	80-120			
Barium	45.2	0.465	"	46.5		97.2	80-120			
Cadmium	44.8	0.465	"	46.5		96.4	80-120			
Copper	45.9	0.929	"	46.5		98.7	80-120			
Selenium	42.1	2.79	"	46.5		90.6	80-120			
Silver	43.7	0.465	"	46.5		94	80-120			
Lead	44.9	0.929	"	46.5		96.6	80-120			
DUP (1203538869 D)		**Source: 396300001**			Prepared: 04/30/2016 Analyzed: 05/02/2016					
Cadmium	ND	0.508	mg/kg		<0.102		0-20	4.56	20	U
Barium	35.3	0.508	"		26.0		0-20	30.2	20	
Chromium	3.84	0.508	"		2.98		0-20	25.4	20	
Copper	3.36	1.02	"		3.10		0-20	7.98	20	
Lead	7.91	1.02	"		4.04		0-20	64.7	20	
Silver	ND	0.508	"		<0.102		0-20	41.9	20	U
Arsenic	1.59	3.05	"		1.23		0-20	25.6	20	J

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1563659 - SW846 3050B										
DUP (1203538869 D)		**Source: 396300001**			Prepared: 04/30/2016 Analyzed: 05/02/2016					
Selenium	ND	3.05	mg/kg		<0.508		0-20	152	20	U
MS (1203538870 S)		**Source: 396300001**			Prepared: 04/30/2016 Analyzed: 05/02/2016					
Silver	50.2	0.511	mg/kg	51.1	<0.102	98.3	75-125			
Arsenic	51.7	3.06	"	51.1	1.23	98.8	75-125			
Barium	76.1	0.511	"	51.1	26.0	98.1	75-125			
Cadmium	50.9	0.511	"	51.1	<0.102	99.6	75-125			
Chromium	53.6	0.511	"	51.1	2.98	99.2	75-125			
Copper	56.9	1.02	"	51.1	3.10	105	75-125			
Lead	56.2	1.02	"	51.1	4.04	102	75-125			
Selenium	48.6	3.06	"	51.1	<0.511	95.1	75-125			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Total Metals by 7196A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1563760 - SW846 3060A										
BLANK (1203539082-BLK)					Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	ND	0.396	mg/kg				-			U
LCS (1203539083-BKS)					Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	3.76	0.399	mg/kg	3.99		94.2	80-120			
ILCS (1203539084-ILCS)					Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	6.50	0.399	mg/kg	7.97		81.5	80-120			
DUP (1203539133 D)		**Source: X604294-03**			Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	ND	4.39	mg/kg		2.50		0-50	86.5	50	U
MS (1203539136 S)		**Source: X604294-03**			Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	5.00	4.37	mg/kg	4.37	2.50	57.2	75-125			
MSD (1203539137 SD)		**Source: X604294-03**			Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	4.02	4.40	mg/kg	4.40	2.50	34.6	75-125	21.7	30	J
PS (1203540103 S)		**Source: X604294-03**			Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	2.50	0.110	mg/kg	0.100		222	85-115			
PSD (1203540104 SD)		**Source: X604294-03**			Prepared: 04/29/2016 Analyzed: 05/03/2016					
Hexavalent Chromium	2.59	0.110	mg/kg	0.100		230	85-115	3.47	30	

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Total Metals by 7471A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1563868 - SW846 7471A Prep										
BLANK (1203539371-BLK)					Prepared: 05/02/2016 Analyzed: 05/03/2016					
Mercury	ND	0.0114	mg/kg				-			U
LCS (1203539372-BKS)					Prepared: 05/02/2016 Analyzed: 05/03/2016					
Mercury	0.119	0.0118	mg/kg	0.118		101	80-120			
DUP (1203539373 D)		**Source: X604294-01**			Prepared: 05/02/2016 Analyzed: 05/03/2016					
Mercury	ND	0.0114	mg/kg		<0.00383		0-20	65.2	20	U
MS (1203539374 S)		**Source: X604294-01**			Prepared: 05/02/2016 Analyzed: 05/03/2016					
Mercury	0.127	0.0122	mg/kg	0.122	<0.00409	103	80-120			

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal Phase II

Notes and Definitions

Ua Sample is Non-Detect.

U Result not detected above the detection limit

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

J Greater than the detection limit but less than the reporting limit

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

June 28, 2016

Pinyon

Corinne Wardell

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

Project Name - 710 Federal **Project Number - 11600702**

Attached are your analytical results for 710 Federal received by Origins Laboratory, Inc. June 23, 2016. This project is associated with Origins project number X606280-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RW02-SS02R-6-8	X606280-01	Soil	June 22, 2016 11:00	06/23/2016 16:15
RW02-SS02R-23-25	X606280-02	Soil	June 22, 2016 11:05	06/23/2016 16:15
RW02-SS03R-6-8	X606280-03	Soil	June 22, 2016 12:05	06/23/2016 16:15
RW02-SS03R-16-18	X606280-04	Soil	June 22, 2016 12:10	06/23/2016 16:15
RW02-SS05R-15-17	X606280-05	Soil	June 22, 2016 13:15	06/23/2016 16:15
RW02-SS05R-22-24	X606280-06	Soil	June 22, 2016 13:20	06/23/2016 16:15
RW02-SS04R-10-12	X606280-07	Soil	June 22, 2016 14:40	06/23/2016 16:15
RW02-SS04R-17.5-20	X606280-08	Soil	June 22, 2016 14:45	06/23/2016 16:15
RW02-SS01R-6-8	X606280-09	Soil	June 22, 2016 15:50	06/23/2016 16:15
RW02-SS01R-20-22	X606280-10	Soil	June 22, 2016 15:55	06/23/2016 16:15

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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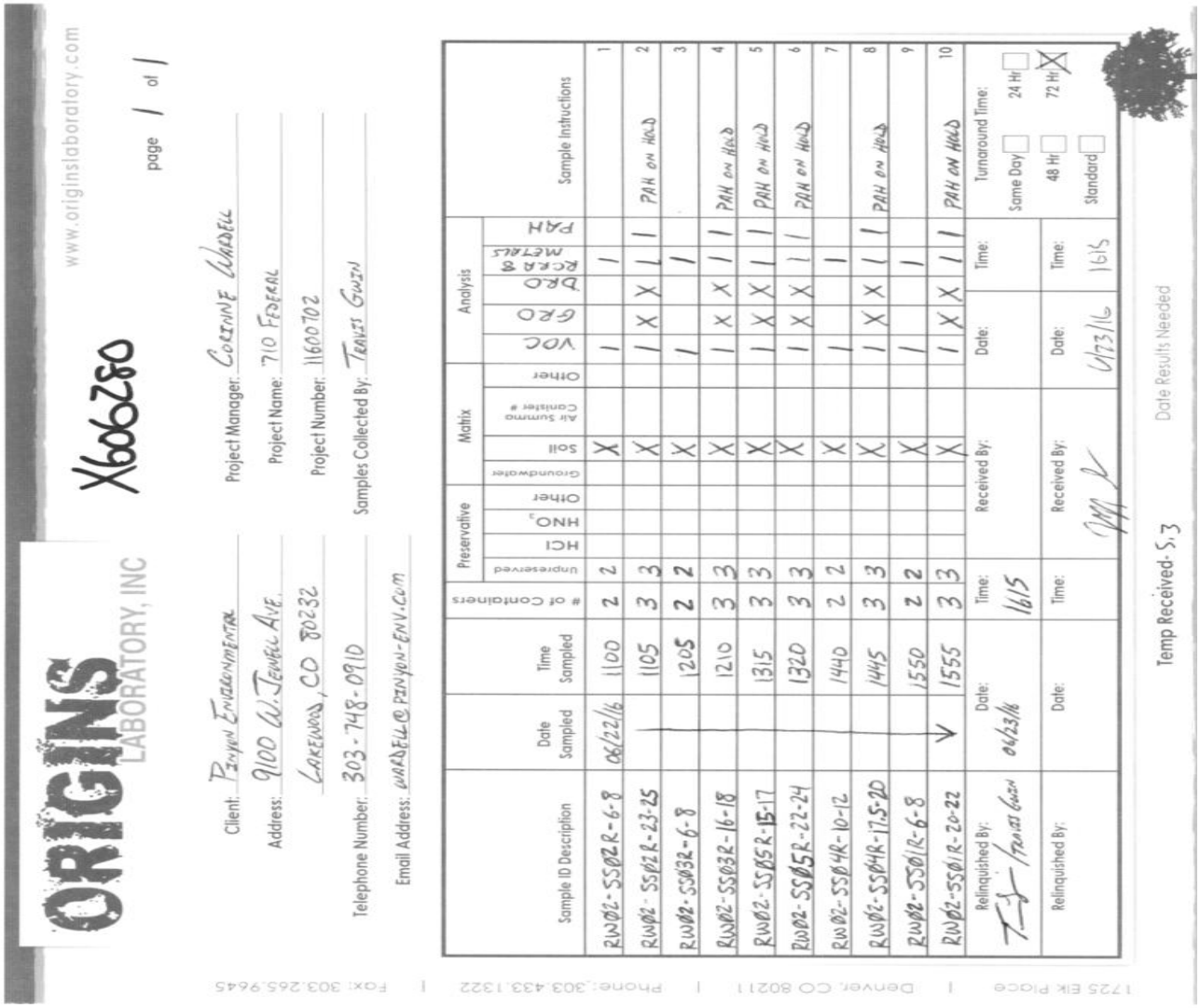
ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal



Origins Laboratory, Inc.

Jen Pellegrini

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Origins Laboratory F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: XL600230 Client: Pinyon
Client Project ID: 710 Federal

Checklist Completed by: Jeff Smith Shipped Via: H/D (UPS, FedEx, Hand Delivered, Pick-up, etc.)
Date/time completed: 6/23/16 Airbill #: N/A

Matrix(s) Received: (Check all that apply): X Soil/Solid ____ Water ____ Other: ____ (Describe)

Cooler Number/Temperature: 1 / 5.3 °C ____ / ____ °C ____ / ____ °C ____ / ____ °C

Thermometer ID: TD03

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]?	X			
Is there ice present (document if blue ice is used)	X			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		X		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		X		
Were all samples received intact[1]?	X			
Was adequate sample volume provided[1]?	X			
Are short holding time analytes or samples with HTs due within 48 hours present[1]?		X		
Is a chain-of-custody (COC) present and filled out completely[1]?	X			
Does the COC agree with the number and type of sample bottles received[1]?	X			
Do the sample IDs on the bottle labels match the COC[1]?	X			
Is the COC properly relinquished by the client with date and time recorded[1]?	X			
For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.**			X	
Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / (pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)*			X	
Additional Comments (if any):				

[1]If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Reviewed by (Project Manager) 6/24/16 Date/Time Reviewed

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS02R-6-8
6/22/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606280-01 (Soil)									
Total Metals by 6010C									
Arsenic	**4.73**	**0.559**	3.36	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**310**	**0.112**	0.559	"	"	"	"	"	
Cadmium	ND	0.112	0.559	"	"	"	"	"	U
Chromium	**11.3**	**0.168**	0.559	"	"	"	"	"	
Lead	**6.77**	**0.369**	1.12	"	"	"	"	"	
Selenium	**0.824**	**0.559**	3.36	"	"	"	"	"	J
Silver	**0.183**	**0.112**	0.559	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.00698**	**0.00437**	0.013	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND		0.00500	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS02R-6-8
6/22/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-01 (Soil)

VOC by EPA 8260C

1,2,4-Trichlorobenzene	ND	0.00500	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS02R-6-8
6/22/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-01 (Soil)

VOC by EPA 8260C

Bromobenzene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS02R-6-8
6/22/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-01 (Soil)

VOC by EPA 8260C

Methyl tert-Butyl Ether	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Trichloroethene	ND	0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*103 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*97.9 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS02R-6-8
6/22/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-01 (Soil)

VOC by EPA 8260C

Surrogate: 4-Bromofluorobenzene	*110 %*		*70-130*			*B6F2403*	*06/24/2016*	*06/24/2016*	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS02R-23-25
6/22/2016 11:05:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-02 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6F2404	06/24/2016	06/24/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*61.7 %*		*59-131*			"	"	"	
Total Metals by 6010C									
Arsenic	**4.38**	**0.604**	3.62	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**249**	**0.121**	0.604	"	"	"	"	"	
Cadmium	ND	0.121	0.604	"	"	"	"	"	U
Chromium	**11.9**	**0.181**	0.604	"	"	"	"	"	
Lead	**11.6**	**0.398**	1.21	"	"	"	"	"	
Selenium	ND	0.604	3.62	"	"	"	"	"	U
Silver	**0.251**	**0.121**	0.604	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.00856**	**0.00486**	0.0145	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS02R-23-25
6/22/2016 11:05:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-02 (Soil)

VOC by EPA 8260C

1,1,2,2-Tetrachloroethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Project Number: 11600702
Project: 710 Federal

RW02-SS02R-23-25
6/22/2016 11:05:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-02 (Soil)

VOC by EPA 8260C

2-Chlorotoluene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

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Corinne Wardell
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Project: 710 Federal

RW02-SS02R-23-25
6/22/2016 11:05:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-02 (Soil)

VOC by EPA 8260C

Dibromochloromethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

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6/22/2016 11:05:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-02 (Soil)

VOC by EPA 8260C

Trichloroethene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*103 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*97.0 %*	*70-130*	"	"	"
Surrogate: 4-Bromofluorobenzene	*110 %*	*70-130*	"	"	"

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-6-8
6/22/2016 12:05:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606280-03 (Soil)									
Total Metals by 6010C									
Arsenic	**4.46**	**0.561**	3.37	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**229**	**0.112**	0.561	"	"	"	"	"	
Cadmium	**0.140**	**0.112**	0.561	"	"	"	"	"	J
Chromium	**13.5**	**0.168**	0.561	"	"	"	"	"	
Lead	**9.75**	**0.371**	1.12	"	"	"	"	"	
Selenium	ND	0.561	3.37	"	"	"	"	"	U
Silver	**0.170**	**0.112**	0.561	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.00625**	**0.00451**	0.0135	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND		0.00500	"	"	"	"	"	Ua

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Project: 710 Federal

RW02-SS03R-6-8
6/22/2016 12:05:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-03 (Soil)

VOC by EPA 8260C

1,2,4-Trichlorobenzene	ND	0.00500	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-6-8
6/22/2016 12:05:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-03 (Soil)

VOC by EPA 8260C

Bromobenzene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-6-8
6/22/2016 12:05:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-03 (Soil)									
VOC by EPA 8260C									
Methyl tert-Butyl Ether	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Methylene Chloride	ND		0.0200	"	"	"	"	"	Ua
Naphthalene	ND		0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND		0.00200	"	"	"	"	"	Ua
o-Xylene	ND		0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
Styrene	ND		0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND		0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND		0.00200	"	"	"	"	"	Ua
Toluene	ND		0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
Trichloroethene	ND		0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*104 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*97.4 %*		*70-130*			"	"	"	

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9100 West Jewell Avenue, Suite 200
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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-6-8
6/22/2016 12:05:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-03 (Soil)

VOC by EPA 8260C

Surrogate: 4-Bromofluorobenzene	*112 %*		*70-130*			*B6F2403*	*06/24/2016*	*06/24/2016*	

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9100 West Jewell Avenue, Suite 200
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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-16-18
6/22/2016 12:10:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-04 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6F2404	06/24/2016	06/24/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*65.1 %*		*59-131*			"	"	"	
Total Metals by 6010C									
Arsenic	**6.09**	**0.565**	3.39	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**361**	**0.113**	0.565	"	"	"	"	"	
Cadmium	ND	0.113	0.565	"	"	"	"	"	U
Chromium	**6.69**	**1.70**	5.65	"	10	"	"	"	
Lead	**7.07**	**0.373**	1.13	"	1	"	"	"	
Selenium	**0.895**	**0.565**	3.39	"	"	"	"	"	J
Silver	**0.125**	**0.113**	0.565	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.00768**	**0.00425**	0.0127	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-16-18
6/22/2016 12:10:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-04 (Soil)

VOC by EPA 8260C

1,1,2,2-Tetrachloroethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Project Number: 11600702
Project: 710 Federal

RW02-SS03R-16-18
6/22/2016 12:10:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-04 (Soil)

VOC by EPA 8260C

2-Chlorotoluene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-16-18
6/22/2016 12:10:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-04 (Soil)

VOC by EPA 8260C

Dibromochloromethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS03R-16-18
6/22/2016 12:10:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-04 (Soil)

VOC by EPA 8260C

Trichloroethene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*101 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*96.5 %*	*70-130*	"	"	"
Surrogate: 4-Bromofluorobenzene	*110 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-15-17
6/22/2016 1:15:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-05 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6F2404	06/24/2016	06/24/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*65.6 %*		*59-131*			"	"	"	
Total Metals by 6010C									
Arsenic	**3.71**	**0.550**	3.30	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**430**	**0.110**	0.550	"	"	"	"	"	
Cadmium	ND	0.110	0.550	"	"	"	"	"	U
Chromium	**8.53**	**0.165**	0.550	"	"	"	"	"	
Lead	**6.86**	**0.363**	1.10	"	"	"	"	"	
Selenium	ND	0.550	3.30	"	"	"	"	"	U
Silver	**0.136**	**0.110**	0.550	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.00619**	**0.00415**	0.0124	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-15-17
6/22/2016 1:15:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-05 (Soil)

VOC by EPA 8260C

1,1,2,2-Tetrachloroethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-15-17
6/22/2016 1:15:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-05 (Soil)

VOC by EPA 8260C

2-Chlorotoluene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-15-17
6/22/2016 1:15:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-05 (Soil)

VOC by EPA 8260C

Dibromochloromethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
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Project: 710 Federal

RW02-SS05R-15-17
6/22/2016 1:15:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-05 (Soil)

VOC by EPA 8260C

Trichloroethene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*103 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*98.1 %*	*70-130*	"	"	"
Surrogate: 4-Bromofluorobenzene	*111 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-22-24
6/22/2016 1:20:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-06 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6F2404	06/24/2016	06/24/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*63.9 %*		*59-131*			"	"	"	
Total Metals by 6010C									
Arsenic	**3.67**	**0.611**	3.67	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**72.4**	**0.122**	0.611	"	"	"	"	"	
Cadmium	ND	0.122	0.611	"	"	"	"	"	U
Chromium	**10.9**	**0.183**	0.611	"	"	"	"	"	
Lead	**13.9**	**0.403**	1.22	"	"	"	"	"	
Selenium	ND	0.611	3.67	"	"	"	"	"	U
Silver	ND	0.122	0.611	"	"	"	"	"	U
Total Metals by 7471A									
Mercury	**0.00942**	**0.00493**	0.0147	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-22-24
6/22/2016 1:20:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-06 (Soil)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Project Number: 11600702
Project: 710 Federal

RW02-SS05R-22-24
6/22/2016 1:20:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-06 (Soil)

VOC by EPA 8260C

2-Butanone	ND	0.0100	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-22-24
6/22/2016 1:20:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-06 (Soil)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS05R-22-24
6/22/2016 1:20:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-06 (Soil)

VOC by EPA 8260C

trans-1,3-Dichloropropene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Trichloroethene	ND	0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*108 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*94.8 %*	*70-130*	"	"	"
Surrogate: 4-Bromofluorobenzene	*111 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-10-12
6/22/2016 2:40:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606280-07 (Soil)									
Total Metals by 6010C									
Arsenic	**4.29**	**0.516**	3.09	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**310**	**0.103**	0.516	"	"	"	"	"	
Cadmium	**0.117**	**0.103**	0.516	"	"	"	"	"	J
Chromium	**13.2**	**0.155**	0.516	"	"	"	"	"	
Lead	**9.41**	**0.340**	1.03	"	"	"	"	"	
Selenium	ND	0.516	3.09	"	"	"	"	"	U
Silver	**0.130**	**0.103**	0.516	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.00685**	**0.00425**	0.0127	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND		0.00500	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-10-12
6/22/2016 2:40:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-07 (Soil)

VOC by EPA 8260C

1,2,4-Trichlorobenzene	ND	0.00500	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-10-12
6/22/2016 2:40:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-07 (Soil)

VOC by EPA 8260C

Bromobenzene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-10-12
6/22/2016 2:40:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-07 (Soil)

VOC by EPA 8260C

Methyl tert-Butyl Ether	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Trichloroethene	ND	0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*108 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*97.2 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-10-12
6/22/2016 2:40:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-07 (Soil)

VOC by EPA 8260C

Surrogate: 4-Bromofluorobenzene	*109 %*		*70-130*			*B6F2403*	*06/24/2016*	*06/24/2016*	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-17.5-20
6/22/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-08 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6F2404	06/24/2016	06/24/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*64.1 %*		*59-131*			"	"	"	
Total Metals by 6010C									
Arsenic	**3.87**	**0.529**	3.17	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**378**	**0.106**	0.529	"	"	"	"	"	
Cadmium	**0.129**	**0.106**	0.529	"	"	"	"	"	J
Chromium	**9.95**	**0.159**	0.529	"	"	"	"	"	
Lead	**7.25**	**0.349**	1.06	"	"	"	"	"	
Selenium	ND	0.529	3.17	"	"	"	"	"	U
Silver	ND	0.106	0.529	"	"	"	"	"	U
Total Metals by 7471A									
Mercury	**0.00539**	**0.00401**	0.012	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-17.5-20
6/22/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-08 (Soil)

VOC by EPA 8260C

1,1,2,2-Tetrachloroethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-17.5-20
6/22/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-08 (Soil)

VOC by EPA 8260C

2-Chlorotoluene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-17.5-20
6/22/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-08 (Soil)

VOC by EPA 8260C

Dibromochloromethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS04R-17.5-20
6/22/2016 2:45:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-08 (Soil)

VOC by EPA 8260C

Trichloroethene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*103 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*96.3 %*	*70-130*	"	"	"
Surrogate: 4-Bromofluorobenzene	*111 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS01R-6-8
6/22/2016 3:50:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606280-09 (Soil)									
Total Metals by 6010C									
Arsenic	**4.84**	**0.515**	3.09	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**316**	**0.103**	0.515	"	"	"	"	"	
Cadmium	**0.178**	**0.103**	0.515	"	"	"	"	"	J
Chromium	**9.62**	**0.154**	0.515	"	"	"	"	"	
Lead	**6.92**	**0.340**	1.03	"	"	"	"	"	
Selenium	ND	0.515	3.09	"	"	"	"	"	U
Silver	**0.143**	**0.103**	0.515	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.00756**	**0.00422**	0.0126	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND		0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND		0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND		0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND		0.00500	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS01R-6-8
6/22/2016 3:50:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-09 (Soil)

VOC by EPA 8260C

1,2,4-Trichlorobenzene	ND	0.00500	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua
2-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS01R-6-8
6/22/2016 3:50:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-09 (Soil)

VOC by EPA 8260C

Bromobenzene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Dibromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS01R-6-8
6/22/2016 3:50:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-09 (Soil)

VOC by EPA 8260C

Methyl tert-Butyl Ether	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
Trichloroethene	ND	0.00200	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND	0.00200	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*106 %*	*70-130*	"	"	"
Surrogate: Toluene-d8	*97.2 %*	*70-130*	"	"	"

Origins Laboratory, Inc.

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RW02-SS01R-6-8
6/22/2016 3:50:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-09 (Soil)

VOC by EPA 8260C

Surrogate: 4-Bromofluorobenzene	*108 %*		*70-130*			*B6F2403*	*06/24/2016*	*06/24/2016*	

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

RW02-SS01R-20-22
6/22/2016 3:55:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-10 (Soil)									
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		50.0	mg/kg	1	B6F2404	06/24/2016	06/24/2016	Ua
Diesel (C10-C28)	ND		50.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*69.1 %*		*59-131*			"	"	"	
Total Metals by 6010C									
Arsenic	**3.92**	**0.636**	3.82	mg/kg dry	1	1577254	06/24/2016	06/27/2016	
Barium	**189**	**0.127**	0.636	"	"	"	"	"	
Cadmium	ND	0.127	0.636	"	"	"	"	"	U
Chromium	**10.4**	**0.191**	0.636	"	"	"	"	"	
Lead	**11.7**	**0.420**	1.27	"	"	"	"	"	
Selenium	ND	0.636	3.82	"	"	"	"	"	U
Silver	**0.243**	**0.127**	0.636	"	"	"	"	"	J
Total Metals by 7471A									
Mercury	**0.0115**	**0.00501**	0.0149	mg/kg dry	1	1577058	"	06/27/2016	J
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,1-Trichloroethane	ND		0.00200	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
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Project: 710 Federal

RW02-SS01R-20-22
6/22/2016 3:55:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-10 (Soil)

VOC by EPA 8260C

1,1,2,2-Tetrachloroethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
1,1,2-Trichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	0.00500	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	0.00200	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	0.00200	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	0.00200	"	"	"	"	"	Ua
2-Butanone	ND	0.0100	"	"	"	"	"	Ua

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6/22/2016 3:55:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-10 (Soil)

VOC by EPA 8260C

2-Chlorotoluene	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
2-Hexanone	ND	0.0100	"	"	"	"	"	Ua
4-Chlorotoluene	ND	0.00200	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	0.00200	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	0.0100	"	"	"	"	"	Ua
Acetone	ND	0.0200	"	"	"	"	"	Ua
Benzene	ND	0.00200	"	"	"	"	"	Ua
Bromobenzene	ND	0.00200	"	"	"	"	"	Ua
Bromochloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromodichloromethane	ND	0.00200	"	"	"	"	"	Ua
Bromoform	ND	0.00200	"	"	"	"	"	Ua
Bromomethane	ND	0.00200	"	"	"	"	"	Ua
Carbon disulfide	ND	0.00500	"	"	"	"	"	Ua
Carbon tetrachloride	ND	0.00200	"	"	"	"	"	Ua
Chlorobenzene	ND	0.00200	"	"	"	"	"	Ua
Chloroethane	ND	0.00500	"	"	"	"	"	Ua
Chloroform	ND	0.00200	"	"	"	"	"	Ua
Chloromethane	ND	0.00200	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

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Project: 710 Federal

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6/22/2016 3:55:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606280-10 (Soil)

VOC by EPA 8260C

Dibromochloromethane	ND	0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Dibromomethane	ND	0.00200	"	"	"	"	"	Ua
Ethylbenzene	ND	0.00200	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	0.00500	"	"	"	"	"	Ua
Iodomethane	ND	0.0150	"	"	"	"	"	Ua
Isopropylbenzene	ND	0.00200	"	"	"	"	"	Ua
m,p-Xylene	ND	0.00400	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	0.00200	"	"	"	"	"	Ua
Methylene Chloride	ND	0.0200	"	"	"	"	"	Ua
Naphthalene	ND	0.0100	"	"	"	"	"	Ua
n-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
n-Propylbenzene	ND	0.00200	"	"	"	"	"	Ua
o-Xylene	ND	0.00200	"	"	"	"	"	Ua
sec-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Styrene	ND	0.00200	"	"	"	"	"	Ua
tert-Butylbenzene	ND	0.00200	"	"	"	"	"	Ua
Tetrachloroethene	ND	0.00200	"	"	"	"	"	Ua
Toluene	ND	0.00200	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	0.00200	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	0.00200	"	"	"	"	"	Ua

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Project Number: 11600702
Project: 710 Federal

RW02-SS01R-20-22
6/22/2016 3:55:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606280-10 (Soil)									
VOC by EPA 8260C									
Trichloroethene	ND		0.00200	mg/kg	1	B6F2403	06/24/2016	06/24/2016	Ua
Trichlorofluoromethane	ND		0.00300	"	"	"	"	"	Ua
Vinyl chloride	ND		0.00200	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*109 %*		*70-130*			"	"	"	
Surrogate: Toluene-d8	*96.0 %*		*70-130*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*109 %*		*70-130*			"	"	"	

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Blank (B6F2403-BLK1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
1,1,1,2-Tetrachloroethane	ND	0.00200	mg/kg							Ua
1,1,1-Trichloroethane	ND	0.00200	"							Ua
1,1,2,2-Tetrachloroethane	ND	0.00200	"							Ua
1,1,2-Trichloroethane	ND	0.00200	"							Ua
1,1-Dichloroethane	ND	0.00200	"							Ua
1,1-Dichloroethene	ND	0.00200	"							Ua
1,1-Dichloropropene	ND	0.00200	"							Ua
1,2,3-Trichlorobenzene	ND	0.00500	"							Ua
1,2,3-Trichloropropane	ND	0.00500	"							Ua
1,2,4-Trichlorobenzene	ND	0.00500	"							Ua
1,2,4-Trimethylbenzene	ND	0.00200	"							Ua
1,2-Dibromo-3-chloropropane	ND	0.00500	"							Ua
1,2-Dibromoethane (EDB)	ND	0.00200	"							Ua
1,2-Dichlorobenzene	ND	0.00200	"							Ua
1,2-Dichloroethane	ND	0.00200	"							Ua
1,2-Dichloropropane	ND	0.00200	"							Ua
1,3,5-Trimethylbenzene	ND	0.00200	"							Ua
1,3-Dichlorobenzene	ND	0.00200	"							Ua
1,3-Dichloropropane	ND	0.00200	"							Ua
1,4-Dichlorobenzene	ND	0.00200	"							Ua
2,2-Dichloropropane	ND	0.00200	"							Ua
2-Butanone	ND	0.0100	"							Ua
2-Chlorotoluene	ND	0.00200	"							Ua
2-Hexanone	ND	0.0100	"							Ua
4-Chlorotoluene	ND	0.00200	"							Ua
4-Isopropyltoluene	ND	0.00200	"							Ua

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Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Blank (B6F2403-BLK1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
4-Methyl-2-pentanone	ND	0.0100	mg/kg							Ua
Acetone	ND	0.0200	"							Ua
Benzene	ND	0.00200	"							Ua
Bromobenzene	ND	0.00200	"							Ua
Bromochloromethane	ND	0.00200	"							Ua
Bromodichloromethane	ND	0.00200	"							Ua
Bromoform	ND	0.00200	"							Ua
Bromomethane	ND	0.00200	"							Ua
Carbon disulfide	ND	0.00500	"							Ua
Carbon tetrachloride	ND	0.00200	"							Ua
Chlorobenzene	ND	0.00200	"							Ua
Chloroethane	ND	0.00500	"							Ua
Chloroform	ND	0.00200	"							Ua
Chloromethane	ND	0.00200	"							Ua
cis-1,2-Dichloroethene	ND	0.00200	"							Ua
cis-1,3-Dichloropropene	ND	0.00200	"							Ua
Dibromochloromethane	ND	0.00200	"							Ua
Dibromomethane	ND	0.00200	"							Ua
Ethylbenzene	ND	0.00200	"							Ua
Hexachlorobutadiene	ND	0.00500	"							Ua
Iodomethane	ND	0.0150	"							Ua
Isopropylbenzene	ND	0.00200	"							Ua
m,p-Xylene	ND	0.00400	"							Ua
Methyl tert-Butyl Ether	ND	0.00200	"							Ua
Methylene Chloride	ND	0.0200	"							Ua
Naphthalene	ND	0.0100	"							Ua

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Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Blank (B6F2403-BLK1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
n-Butylbenzene	ND	0.00200	mg/kg							Ua
n-Propylbenzene	ND	0.00200	"							Ua
o-Xylene	ND	0.00200	"							Ua
sec-Butylbenzene	ND	0.00200	"							Ua
Styrene	ND	0.00200	"							Ua
tert-Butylbenzene	ND	0.00200	"							Ua
Tetrachloroethene	ND	0.00200	"							Ua
Toluene	ND	0.00200	"							Ua
trans-1,2-Dichloroethene	ND	0.00200	"							Ua
trans-1,3-Dichloropropene	ND	0.00200	"							Ua
Trichloroethene	ND	0.00200	"							Ua
Trichlorofluoromethane	ND	0.00300	"							Ua
Vinyl chloride	ND	0.00200	"							Ua
Surrogate: 1,2-Dichloroethane-d4	*67*		*ug/L*	*62.5*		*107*	*70-130*			
Surrogate: Toluene-d8	*60*		*"*	*62.5*		*96.4*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*69*		*"*	*62.5*		*110*	*70-130*			

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Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
LCS (B6F2403-BS1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
1,1,1,2-Tetrachloroethane	0.0977	0.00200	mg/kg	0.100		97.7	70-130			
1,1,1-Trichloroethane	0.0949	0.00200	"	0.100		94.9	70-130			
1,1,2,2-Tetrachloroethane	0.0930	0.00200	"	0.100		93.0	70-130			
1,1,2-Trichloroethane	0.108	0.00200	"	0.100		108	70-130			
1,1-Dichloroethane	0.102	0.00200	"	0.100		102	70-130			
1,1-Dichloroethene	0.0990	0.00200	"	0.100		99.0	70-130			
1,1-Dichloropropene	0.101	0.00200	"	0.100		101	70-130			
1,2,3-Trichlorobenzene	0.0947	0.00500	"	0.100		94.7	70-130			
1,2,3-Trichloropropane	0.104	0.00500	"	0.100		104	70-130			
1,2,4-Trichlorobenzene	0.0972	0.00500	"	0.100		97.2	70-130			
1,2,4-Trimethylbenzene	0.104	0.00200	"	0.100		104	70-130			
1,2-Dibromo-3-chloropropane	0.0998	0.00500	"	0.100		99.8	70-130			
1,2-Dibromoethane (EDB)	0.106	0.00200	"	0.100		106	70-130			
1,2-Dichlorobenzene	0.0977	0.00200	"	0.100		97.7	70-130			
1,2-Dichloroethane	0.0983	0.00200	"	0.100		98.3	70-130			
1,2-Dichloropropane	0.100	0.00200	"	0.100		100	70-130			
1,3,5-Trimethylbenzene	0.103	0.00200	"	0.100		103	70-130			
1,3-Dichlorobenzene	0.0991	0.00200	"	0.100		99.1	70-130			
1,3-Dichloropropane	0.103	0.00200	"	0.100		103	70-130			
1,4-Dichlorobenzene	0.0995	0.00200	"	0.100		99.5	70-130			
2,2-Dichloropropane	0.0956	0.00200	"	0.100		95.6	70-130			
2-Butanone	0.458	0.0100	"	0.500		91.6	70-130			
2-Chlorotoluene	0.102	0.00200	"	0.100		102	70-130			
2-Hexanone	0.468	0.0100	"	0.500		93.5	70-130			
4-Chlorotoluene	0.101	0.00200	"	0.100		101	70-130			
4-Isopropyltoluene	0.104	0.00200	"	0.100		104	70-130			

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
LCS (B6F2403-BS1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
4-Methyl-2-pentanone	0.498	0.0100	mg/kg	0.500		99.7	70-130			
Acetone	0.471	0.0200	"	0.500		94.3	70-130			
Benzene	0.102	0.00200	"	0.100		102	70-130			
Bromobenzene	0.106	0.00200	"	0.100		106	70-130			
Bromochloromethane	0.100	0.00200	"	0.100		100	70-130			
Bromodichloromethane	0.105	0.00200	"	0.100		105	70-130			
Bromoform	0.0999	0.00200	"	0.100		99.9	70-130			
Bromomethane	0.0961	0.00200	"	0.100		96.1	70-130			
Carbon disulfide	0.0957	0.00500	"	0.100		95.7	70-130			
Carbon tetrachloride	0.0994	0.00200	"	0.100		99.4	70-130			
Chlorobenzene	0.102	0.00200	"	0.100		102	70-130			
Chloroethane	0.0950	0.00500	"	0.100		95.0	70-130			
Chloroform	0.103	0.00200	"	0.100		103	70-130			
Chloromethane	0.0863	0.00200	"	0.100		86.3	70-130			
cis-1,2-Dichloroethene	0.103	0.00200	"	0.100		103	70-130			
cis-1,3-Dichloropropene	0.104	0.00200	"	0.100		104	70-130			
Dibromochloromethane	0.103	0.00200	"	0.100		103	70-130			
Dibromomethane	0.101	0.00200	"	0.100		101	70-130			
Ethylbenzene	0.100	0.00200	"	0.100		100	70-130			
Hexachlorobutadiene	0.0996	0.00500	"	0.100		99.6	70-130			
Iodomethane	0.0857	0.0150	"	0.100		85.7	70-130			
Isopropylbenzene	0.103	0.00200	"	0.100		103	70-130			
m,p-Xylene	0.206	0.00400	"	0.200		103	70-130			
Methyl tert-Butyl Ether	0.104	0.00200	"	0.100		104	70-130			
Methylene Chloride	0.0757	0.0200	"	0.100		75.7	70-130			
Naphthalene	0.0973	0.0100	"	0.100		97.3	70-130			

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
LCS (B6F2403-BS1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
n-Butylbenzene	0.102	0.00200	mg/kg	0.100		102	70-130			
n-Propylbenzene	0.104	0.00200	"	0.100		104	70-130			
o-Xylene	0.0999	0.00200	"	0.100		99.9	70-130			
sec-Butylbenzene	0.105	0.00200	"	0.100		105	70-130			
Styrene	0.104	0.00200	"	0.100		104	70-130			
tert-Butylbenzene	0.104	0.00200	"	0.100		104	70-130			
Tetrachloroethene	0.100	0.00200	"	0.100		100	70-130			
Toluene	0.101	0.00200	"	0.100		101	70-130			
trans-1,2-Dichloroethene	0.101	0.00200	"	0.100		101	70-130			
trans-1,3-Dichloropropene	0.104	0.00200	"	0.100		104	70-130			
Trichloroethene	0.106	0.00200	"	0.100		106	70-130			
Trichlorofluoromethane	0.100	0.00300	"	0.100		100	70-130			
Vinyl chloride	0.0864	0.00200	"	0.100		86.4	70-130			
Surrogate: 1,2-Dichloroethane-d4	*57*		*ug/L*	*62.5*		*91.4*	*70-130*			
Surrogate: Toluene-d8	*62*		*"*	*62.5*		*100*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*68*		*"*	*62.5*		*109*	*70-130*			

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Project: 710 Federal

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Matrix Spike (B6F2403-MS1)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
1,1,1,2-Tetrachloroethane	0.0973	0.00200	mg/kg	0.100	ND	97.3	70-130			
1,1,1-Trichloroethane	0.0951	0.00200	"	0.100	ND	95.1	70-130			
1,1,2,2-Tetrachloroethane	0.111	0.00200	"	0.100	ND	111	70-130			
1,1,2-Trichloroethane	0.116	0.00200	"	0.100	ND	116	70-130			
1,1-Dichloroethane	0.103	0.00200	"	0.100	ND	103	70-130			
1,1-Dichloroethene	0.0985	0.00200	"	0.100	ND	98.5	70-130			
1,1-Dichloropropene	0.0988	0.00200	"	0.100	ND	98.8	70-130			
1,2,3-Trichlorobenzene	0.103	0.00500	"	0.100	ND	103	70-130			
1,2,3-Trichloropropane	0.113	0.00500	"	0.100	ND	113	70-130			
1,2,4-Trichlorobenzene	0.100	0.00500	"	0.100	ND	100	70-130			
1,2,4-Trimethylbenzene	0.0979	0.00200	"	0.100	ND	97.9	70-130			
1,2-Dibromo-3-chloropropane	0.124	0.00500	"	0.100	ND	124	70-130			
1,2-Dibromoethane (EDB)	0.116	0.00200	"	0.100	ND	116	70-130			
1,2-Dichlorobenzene	0.0974	0.00200	"	0.100	ND	97.4	70-130			
1,2-Dichloroethane	0.105	0.00200	"	0.100	ND	105	70-130			
1,2-Dichloropropane	0.103	0.00200	"	0.100	ND	103	70-130			
1,3,5-Trimethylbenzene	0.0967	0.00200	"	0.100	ND	96.7	70-130			
1,3-Dichlorobenzene	0.0951	0.00200	"	0.100	ND	95.1	70-130			
1,3-Dichloropropane	0.113	0.00200	"	0.100	ND	113	70-130			
1,4-Dichlorobenzene	0.0966	0.00200	"	0.100	ND	96.6	70-130			
2,2-Dichloropropane	0.0923	0.00200	"	0.100	ND	92.3	70-130			
2-Butanone	0.578	0.0100	"	0.500	ND	116	70-130			
2-Chlorotoluene	0.0961	0.00200	"	0.100	ND	96.1	70-130			
2-Hexanone	0.578	0.0100	"	0.500	ND	116	70-130			
4-Chlorotoluene	0.0960	0.00200	"	0.100	ND	96.0	70-130			
4-Isopropyltoluene	0.0967	0.00200	"	0.100	ND	96.7	70-130			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Matrix Spike (B6F2403-MS1)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
4-Methyl-2-pentanone	0.610	0.0100	mg/kg	0.500	ND	122	70-130			
Acetone	0.618	0.0200	"	0.500	ND	124	70-130			
Benzene	0.103	0.00200	"	0.100	ND	103	70-130			
Bromobenzene	0.106	0.00200	"	0.100	ND	106	70-130			
Bromochloromethane	0.105	0.00200	"	0.100	ND	105	70-130			
Bromodichloromethane	0.110	0.00200	"	0.100	ND	110	70-130			
Bromoform	0.113	0.00200	"	0.100	ND	113	70-130			
Bromomethane	0.0946	0.00200	"	0.100	ND	94.6	70-130			
Carbon disulfide	0.0954	0.00500	"	0.100	ND	95.4	70-130			
Carbon tetrachloride	0.101	0.00200	"	0.100	ND	101	70-130			
Chlorobenzene	0.101	0.00200	"	0.100	ND	101	70-130			
Chloroethane	0.0938	0.00500	"	0.100	ND	93.8	70-130			
Chloroform	0.105	0.00200	"	0.100	ND	105	70-130			
Chloromethane	0.0839	0.00200	"	0.100	ND	83.9	70-130			
cis-1,2-Dichloroethene	0.103	0.00200	"	0.100	ND	103	70-130			
cis-1,3-Dichloropropene	0.108	0.00200	"	0.100	ND	108	70-130			
Dibromochloromethane	0.112	0.00200	"	0.100	ND	112	70-130			
Dibromomethane	0.111	0.00200	"	0.100	ND	111	70-130			
Ethylbenzene	0.0940	0.00200	"	0.100	ND	94.0	70-130			
Hexachlorobutadiene	0.0888	0.00500	"	0.100	ND	88.8	70-130			
Iodomethane	0.0855	0.0150	"	0.100	ND	85.5	70-130			
Isopropylbenzene	0.0968	0.00200	"	0.100	ND	96.8	70-130			
m,p-Xylene	0.193	0.00400	"	0.200	ND	96.7	70-130			
Methyl tert-Butyl Ether	0.122	0.00200	"	0.100	ND	122	70-130			
Methylene Chloride	0.0870	0.0200	"	0.100	ND	87.0	70-130			
Naphthalene	0.114	0.0100	"	0.100	ND	114	70-130			

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Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Matrix Spike (B6F2403-MS1)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
n-Butylbenzene	0.0928	0.00200	mg/kg	0.100	ND	92.8	70-130			
n-Propylbenzene	0.0972	0.00200	"	0.100	ND	97.2	70-130			
o-Xylene	0.0958	0.00200	"	0.100	ND	95.8	70-130			
sec-Butylbenzene	0.0968	0.00200	"	0.100	ND	96.8	70-130			
Styrene	0.100	0.00200	"	0.100	ND	100	70-130			
tert-Butylbenzene	0.0976	0.00200	"	0.100	ND	97.6	70-130			
Tetrachloroethene	0.0948	0.00200	"	0.100	ND	94.8	70-130			
Toluene	0.0985	0.00200	"	0.100	ND	98.5	70-130			
trans-1,2-Dichloroethene	0.101	0.00200	"	0.100	ND	101	70-130			
trans-1,3-Dichloropropene	0.108	0.00200	"	0.100	ND	108	70-130			
Trichloroethene	0.105	0.00200	"	0.100	ND	105	70-130			
Trichlorofluoromethane	0.0960	0.00300	"	0.100	ND	96.0	70-130			
Vinyl chloride	0.0807	0.00200	"	0.100	ND	80.7	70-130			
Surrogate: 1,2-Dichloroethane-d4	*72*		*ug/L*	*62.5*		*114*	*70-130*			
Surrogate: Toluene-d8	*61*		*"*	*62.5*		*97.2*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*68*		*"*	*62.5*		*109*	*70-130*			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Matrix Spike Dup (B6F2403-MSD1)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
1,1,1,2-Tetrachloroethane	0.0942	0.00200	mg/kg	0.100	ND	94.2	70-130	3.15	20	
1,1,1-Trichloroethane	0.0932	0.00200	"	0.100	ND	93.2	70-130	2.02	20	
1,1,2,2-Tetrachloroethane	0.101	0.00200	"	0.100	ND	101	70-130	10.3	20	
1,1,2-Trichloroethane	0.106	0.00200	"	0.100	ND	106	70-130	8.85	20	
1,1-Dichloroethane	0.100	0.00200	"	0.100	ND	100	70-130	3.23	20	
1,1-Dichloroethene	0.0961	0.00200	"	0.100	ND	96.1	70-130	2.40	20	
1,1-Dichloropropene	0.0961	0.00200	"	0.100	ND	96.1	70-130	2.77	20	
1,2,3-Trichlorobenzene	0.0944	0.00500	"	0.100	ND	94.4	70-130	8.98	20	
1,2,3-Trichloropropane	0.108	0.00500	"	0.100	ND	108	70-130	4.81	20	
1,2,4-Trichlorobenzene	0.0912	0.00500	"	0.100	ND	91.2	70-130	9.40	20	
1,2,4-Trimethylbenzene	0.0949	0.00200	"	0.100	ND	94.9	70-130	3.05	20	
1,2-Dibromo-3-chloropropane	0.116	0.00500	"	0.100	ND	116	70-130	6.13	20	
1,2-Dibromoethane (EDB)	0.110	0.00200	"	0.100	ND	110	70-130	5.27	20	
1,2-Dichlorobenzene	0.0925	0.00200	"	0.100	ND	92.5	70-130	5.12	20	
1,2-Dichloroethane	0.102	0.00200	"	0.100	ND	102	70-130	2.70	20	
1,2-Dichloropropane	0.0999	0.00200	"	0.100	ND	99.9	70-130	2.96	20	
1,3,5-Trimethylbenzene	0.0936	0.00200	"	0.100	ND	93.6	70-130	3.32	20	
1,3-Dichlorobenzene	0.0904	0.00200	"	0.100	ND	90.4	70-130	5.04	20	
1,3-Dichloropropane	0.108	0.00200	"	0.100	ND	108	70-130	4.58	20	
1,4-Dichlorobenzene	0.0917	0.00200	"	0.100	ND	91.7	70-130	5.21	20	
2,2-Dichloropropane	0.0891	0.00200	"	0.100	ND	89.1	70-130	3.48	20	
2-Butanone	0.538	0.0100	"	0.500	ND	108	70-130	7.33	20	
2-Chlorotoluene	0.0927	0.00200	"	0.100	ND	92.7	70-130	3.60	20	
2-Hexanone	0.542	0.0100	"	0.500	ND	108	70-130	6.41	20	
4-Chlorotoluene	0.0884	0.00200	"	0.100	ND	88.4	70-130	8.31	20	
4-Isopropyltoluene	0.0925	0.00200	"	0.100	ND	92.5	70-130	4.44	20	

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Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Matrix Spike Dup (B6F2403-MSD1)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
4-Methyl-2-pentanone	0.574	0.0100	mg/kg	0.500	ND	115	70-130	6.20	20	
Acetone	0.586	0.0200	"	0.500	ND	117	70-130	5.31	20	
Benzene	0.0992	0.00200	"	0.100	ND	99.2	70-130	3.76	20	
Bromobenzene	0.102	0.00200	"	0.100	ND	102	70-130	4.15	20	
Bromochloromethane	0.101	0.00200	"	0.100	ND	101	70-130	3.35	20	
Bromodichloromethane	0.108	0.00200	"	0.100	ND	108	70-130	1.98	20	
Bromoform	0.109	0.00200	"	0.100	ND	109	70-130	2.92	20	
Bromomethane	0.0324	0.00200	"	0.100	ND	32.4	70-130	97.9	20	QM-07, QR-03
Carbon disulfide	0.0928	0.00500	"	0.100	ND	92.8	70-130	2.76	20	
Carbon tetrachloride	0.0978	0.00200	"	0.100	ND	97.8	70-130	2.84	20	
Chlorobenzene	0.0966	0.00200	"	0.100	ND	96.6	70-130	4.43	20	
Chloroethane	0.0289	0.00500	"	0.100	ND	28.9	70-130	106	20	QM-07
Chloroform	0.103	0.00200	"	0.100	ND	103	70-130	2.19	20	
Chloromethane	0.0304	0.00200	"	0.100	ND	30.4	70-130	93.5	20	QM-07
cis-1,2-Dichloroethene	0.0991	0.00200	"	0.100	ND	99.1	70-130	3.74	20	
cis-1,3-Dichloropropene	0.104	0.00200	"	0.100	ND	104	70-130	3.97	20	
Dibromochloromethane	0.107	0.00200	"	0.100	ND	107	70-130	4.25	20	
Dibromomethane	0.107	0.00200	"	0.100	ND	107	70-130	3.16	20	
Ethylbenzene	0.0918	0.00200	"	0.100	ND	91.8	70-130	2.35	20	
Hexachlorobutadiene	0.0785	0.00500	"	0.100	ND	78.5	70-130	12.4	20	
Iodomethane	0.0833	0.0150	"	0.100	ND	83.3	70-130	2.54	20	
Isopropylbenzene	0.0941	0.00200	"	0.100	ND	94.1	70-130	2.85	20	
m,p-Xylene	0.189	0.00400	"	0.200	ND	94.3	70-130	2.47	20	
Methyl tert-Butyl Ether	0.118	0.00200	"	0.100	ND	118	70-130	3.48	20	
Methylene Chloride	0.0837	0.0200	"	0.100	ND	83.7	70-130	3.84	20	
Naphthalene	0.104	0.0100	"	0.100	ND	104	70-130	8.78	20	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2403 - EPA 5030 (soil)										
Matrix Spike Dup (B6F2403-MSD1)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
n-Butylbenzene	0.0880	0.00200	mg/kg	0.100	ND	88.0	70-130	5.24	20	
n-Propylbenzene	0.0935	0.00200	"	0.100	ND	93.5	70-130	3.90	20	
o-Xylene	0.0931	0.00200	"	0.100	ND	93.1	70-130	2.84	20	
sec-Butylbenzene	0.0937	0.00200	"	0.100	ND	93.7	70-130	3.26	20	
Styrene	0.0960	0.00200	"	0.100	ND	96.0	70-130	4.14	20	
tert-Butylbenzene	0.0945	0.00200	"	0.100	ND	94.5	70-130	3.19	20	
Tetrachloroethene	0.0915	0.00200	"	0.100	ND	91.5	70-130	3.63	20	
Toluene	0.0948	0.00200	"	0.100	ND	94.8	70-130	3.75	20	
trans-1,2-Dichloroethene	0.0983	0.00200	"	0.100	ND	98.3	70-130	2.29	20	
trans-1,3-Dichloropropene	0.104	0.00200	"	0.100	ND	104	70-130	3.97	20	
Trichloroethene	0.103	0.00200	"	0.100	ND	103	70-130	2.33	20	
Trichlorofluoromethane	0.0242	0.00300	"	0.100	ND	24.2	70-130	119	20	QM-07
Vinyl chloride	0.0292	0.00200	"	0.100	ND	29.2	70-130	93.8	20	QM-07
Surrogate: 1,2-Dichloroethane-d4	*61*		*ug/L*	*62.5*		*97.0*	*70-130*			
Surrogate: Toluene-d8	*61*		*"*	*62.5*		*97.0*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*67*		*"*	*62.5*		*107*	*70-130*			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2404 - EPA 3580										
Blank (B6F2404-BLK1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
Gasoline (C6-C10)	ND	50.0	mg/kg							Ua
Diesel (C10-C28)	ND	50.0	"							Ua
Surrogate: o-Terphenyl	*68*		*"*	*50.0*		*137*	*59-131*			
LCS (B6F2404-BS1)					Prepared: 06/24/2016 Analyzed: 06/24/2016					
Gasoline (C6-C10)	837	50.0	mg/kg	1000		83.7	59-133			
Diesel (C10-C28)	876	50.0	"	1000		87.6	64-121			
Surrogate: o-Terphenyl	*40*		*"*	*50.0*		*79.9*	*59-131*			
Matrix Spike (B6F2404-MS1)		**Source: X606280-02**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
Gasoline (C6-C10)	793	50.0	mg/kg	1000	ND	79.3	57-139			
Diesel (C10-C28)	829	50.0	"	1000	ND	82.9	53-125			
Surrogate: o-Terphenyl	*34*		*"*	*50.0*		*67.8*	*59-131*			
Matrix Spike Dup (B6F2404-MSD1)		**Source: X606280-02**			Prepared: 06/24/2016 Analyzed: 06/24/2016					
Gasoline (C6-C10)	758	50.0	mg/kg	1000	ND	75.8	57-139	4.46	20	
Diesel (C10-C28)	822	50.0	"	1000	ND	82.2	53-125	0.873	20	
Surrogate: o-Terphenyl	*37*		*"*	*50.0*		*74.3*	*59-131*			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1577254 - SW846 3050B										
BLANK (1203574471-BLK)					Prepared: 06/24/2016 Analyzed: 06/27/2016					
Arsenic	ND	2.88	mg/kg				-			U
Barium	ND	0.480	"				-			U
Chromium	ND	0.480	"				-			U
Lead	ND	0.960	"				-			U
Selenium	ND	2.88	"				-			U
Silver	ND	0.480	"				-			U
Cadmium	ND	0.480	"				-			U
LCS (1203574472-BKS)					Prepared: 06/24/2016 Analyzed: 06/27/2016					
Selenium	43.7	2.91	mg/kg	48.5		90	80-120			
Arsenic	45.6	2.91	"	48.5		93.9	80-120			
Barium	46.1	0.485	"	48.5		95	80-120			
Cadmium	46.1	0.485	"	48.5		94.9	80-120			
Lead	45.8	0.971	"	48.5		94.3	80-120			
Silver	44.8	0.485	"	48.5		92.3	80-120			
Chromium	45.3	0.485	"	48.5		93.3	80-120			
DUP (1203574473 D)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/27/2016					
Barium	333	0.574	mg/kg dry		310		0-20	7.32	20	
Cadmium	ND	0.574	"		<0.115		0-20	35.1	20	U
Chromium	10.2	0.574	"		11.3		0-20	10.2	20	
Lead	7.21	1.15	"		6.77		0-20	6.23	20	
Selenium	0.628	3.44	"		0.824		0-20	27	20	J
Silver	0.195	0.574	"		0.183		0-20	6.35	20	J
Arsenic	4.87	3.44	"		4.73		0-20	2.96	20	
MS (1203574474 S)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/27/2016					

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1577254 - SW846 3050B										
MS (1203574474 S)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/27/2016					
Arsenic	56.6	3.42	mg/kg dry	57.1	4.73	90.9	75-125			
Silver	53.3	0.571	"	57.1	0.183	93	75-125			
Lead	59.4	1.14	"	57.1	6.77	92.2	75-125			
Chromium	62.2	0.571	"	57.1	11.3	89.2	75-125			
Barium	399	0.571	"	57.1	310	156	75-125			
Selenium	49.7	3.42	"	57.1	0.824	85.8	75-125			
Cadmium	50.8	0.571	"	57.1	<0.114	88.9	75-125			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Total Metals by 7471A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1577058 - SW846 7471A Prep										
BLANK (1203573976-BLK)					Prepared: 06/24/2016 Analyzed: 06/27/2016					
Mercury	ND	0.0117	mg/kg				-			U
LCS (1203573977-BKS)					Prepared: 06/24/2016 Analyzed: 06/27/2016					
Mercury	0.118	0.0113	mg/kg	0.113		105	80-120			
DUP (1203573978 D)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/27/2016					
Mercury	0.0075	0.0129	mg/kg dry		0.00698		0-20	7.14	20	J
MS (1203573979 S)		**Source: X606280-01**			Prepared: 06/24/2016 Analyzed: 06/27/2016					
Mercury	0.138	0.0124	mg/kg dry	0.124	0.00698	106	80-120			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: 710 Federal

Notes and Definitions

Ua	Sample is Non-Detect.
U	Result not detected above the detection limit
QR-03	The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Greater than the detection limit but less than the reporting limit
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Reservoirs Environmental, Inc.

June 23, 2016

Subcontract Number: **NA**
Laboratory Report: **RES 352478-1R**
Project # / P.O. # **11600702.2102a**
Project Description: **710 Federal Blvd**

Pinyon Environmental Engineering
9100 West Jewell Ave. Suite 200
Lakewood CO 80232

Dear Customer,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA), Lab ID 101533 - Accreditation Certificate #480 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

RES 352478-1R is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,

Elisa Mari for

Jeanne Spencer
President

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 352478-1R**
Client: **Pinyon Environmental Engineering**
Client Project Number / P.O.: **11600702.2102a**
Client Project Description: **710 Federal Blvd**
Date Samples Received: **June 09, 2016**
Method: **EPA 600/R-93/116 - Short Report, Bulk**
Turnaround: **3-5 Day**
Date Samples Analyzed: **June 23, 2016**

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
RW2SB02-PM01	EM 1646223	A	Gray/yellow fibrous resinous material	100		**ND**	75	25
RW2SB03-ASP01	EM 1646224	A	Black granular material w/ brown soil	100		**ND**	0	100
RW2SB03-BR01	EM 1646225	A	Red brick	100		**ND**	0	100
RW2SB01-DEB01	EM 1646226	A	White resinous material w/ tan soil	100		**ND**	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

Paul D. LoScalzo
Analyst / Data QA

Due Date: ~~6/14/16~~ 6/14-16
Due Time: ____________

REI LAB **Reservoirs Environmental, Inc.**
5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV
After Hours Cell Phone: 720-339-9228

RES 352478

SUBMITTED BY:	**INVOICE TO: (IF DIFFERENT)**	**CONTACT INFORMATION:**	
Company: Pinyon Env.	Company:	Contact: Sheree T-Porter	Contact:
Address: 900 W. Jewell Ave	Address:	Phone: 720 933-0853	Phone:
		Fax:	Fax:
		Cell/pager:	Cell/pager:
Project Number and/or P.O. #: 1160072.2102a		Final Data Deliverable Email Address: thomas-porter, wardell, white-hughes@pinyon.com	
Project Description/Location: 710 Federal blvd			

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm
(PLM circled) / PCM / TEM ___ RUSH (Same Day) ___ PRIORITY (Next Day) ✓ STANDARD (3-5 Day)
(Rush PCM = 2hr, TEM = 6hr.)

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm
Metal(s) / Dust** ___ RUSH ___ 24 hr. ___ 3-5 Day
RCRA 8 / Metals & Welding Fume Scan / TCLP** ___ RUSH (3 Day) ___ 5 Day ___ 10 Day
Organics ___ 24 hr. ___ 3 day ___ 5 Day
Prior notification is required for RUSH turnarounds.

MICROBIOLOGY LABORATORY HOURS: Weekdays: 8am - 5pm
E.coli and/or Coliforms* ___ 24-48 Hour Other: ________
Pathogens* ___ 24-48 Hour
Microbial Growth* ___ 5-10 Day
Legionella ___ 10 Day
Mold ___ RUSH ___ 24 Hr ___ 48 Hr ___ 3 Day ___ 5 Day
TAT dependent on speed of microbial growth.

Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.

Special Instructions: Please call + email results

REQUESTED ANALYSIS
- PLM - Short report, Point Count, Long report, Qualitative
- TEM - AHERA, Level II, 7402, ISO, +/- (Air, Bulk or Dust), Quant, Semi-Quant, Micro-vac, ISO-Indirect Preps
- PCM - 7400A, 7400B, OSHA
- DUST - Total, Respirable
- METALS - Analyte(s) ______ RCRA 8, TCLP, Welding Fume, Metals Scan, pH
- ORGANICS - METH, TSS
- MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S aureus, Camphlobacter: +/- or Quantification; E.coli and/or Coliforms: +/- or Quantification; Microbial Growth: Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification; Legionella: +/- or Quantification; Other: Bioburden, LAL or Environmental; Mold: Spore Trap or Bulk: +/-, Identification, Quantification
- SAMPLER'S INITIALS OR OTHER NOTES:

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

	Client sample ID number (Sample ID's must be unique)	PLM	TEM	PCM	DUST	METALS	ORGANICS	Pathogens	E.coli and/or Coliforms	Microbial Growth	Legionella	Other	Mold	Sampler's Initials or Other Notes	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
1	RW2SB02-PM01 (5-10)	|												4.		B				1646223
2	RW2SB03-ASP01 (0-5)	|												|		|				4
3	RW2SB03-BR01 (0-5)	|												|		|				5
4	RW2SB01-DEB01 (20-25)	|												|		|				6
5																				
6																				
7																				
8																				
9																				
10																				

Number of samples received: 4 (Additional samples shall be listed on attached long form.)

NOTE: REI will analyze incoming samples based upon information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days, failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By: Sheree T-Porter Date/Time: 6/9/16
Laboratory Use Only
Received By: Emily Casey Date/Time: 6/9/16 2:10pm Carrier: (Hand circled) / FedEx / UPS / USPS / Drop Box / Courier

Sample Condition: On Ice Yes / No Sealed Yes / No Intact (Yes circled) / No
Temp. (F°) ______

Data Entry	Contact	Phone Email Fax (circled)	Date	Time	Initials	Contact	Phone Email Fax	Date	Time	Initials
QA:	Contact	Phone Email Fax	Date	Time	Initials	Contact	Phone Email Fax	Date	Time	Initials

4-2014_version 1

REI LAB **Reservoirs Environmental, Inc.**

May 5, 2016

Subcontract Number: **NA**
Laboratory Report: **RES 348851-1**
Project # / P.O. # **11600702**
Project Description: **Federal Blvd. Ph. II**

Tim Grenier
Pinyon Environmental Engineering
9100 West Jewell Ave. Suite 200
Lakewood CO 80232

Dear Customer,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA), Lab ID 101533 - Accreditation Certificate #480 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

RES 348851-1 is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,

Gina Vettraino for

Jeanne Spencer
President

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 348851-1**
Client: **Pinyon Environmental Engineering**
Client Project Number / P.O.: **11600702**
Client Project Description: **Federal Blvd. Ph. II**
Date Samples Received: **April 28, 2016**
Method: **EPA 600/R-93/116 - Short Report, Bulk**
Turnaround: **3-5 Day**
Date Samples Analyzed: **May 05, 2016**

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
RW31-OT01	EM 1618933	A	Beige granular plaster	100		**ND**	TR	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

Brett S. Colbert
Analyst / Data QA

Due Date: 5-3-5-5
Due Time: 9:45

Reservoirs Environmental, Inc.

REI LAB

5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

After Hours Cell Phone: 720-339-9228

RES 348851

SUBMITTED BY:

Company: Pinyon
Address: 9100 W Jewell Ave
Lakewood, Co 80232

INVOICE TO: (IF DIFFERENT)

Company:
Address:

CONTACT INFORMATION:

Contact: Tim Grenier
Phone: 303.980.5200
Fax:
Cell/pager:

Contact:
Phone:
Fax:
Cell/pager:

Project Number and/or P.O. #: 116000702
Project Description/Location: Federal Blvd Ph II

Final Data Deliverable Email Address: grenier@pinyon-env.com

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm

PLM / PCM / TEM ___ RUSH (Same Day) ___ PRIORITY (Next Day) ✓ STANDARD (3-5 Day)
(Rush PCM = 2hr, TEM = 6hr.)

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm

Metal(s) / Dust** ___ RUSH ___ 24 hr. ___3-5 Day
RCRA 8 / Metals & Welding Fume Scan / TCLP** __RUSH (3 Day)__5 Day __10 Day
Organics ___ 24 hr. ___ 3 day ___5 Day

Prior notification is required for RUSH turnarounds.

MICROBIOLOGY LABORATORY HOURS: Weekdays: 8am - 5pm

E.coli and/or Coliforms* ___24-48 Hour Other: _____
Pathogens* ___24-48 Hour
Microbial Growth* ___5-10 Day
Legionella ___10 Day
Mold ___ RUSH ___24 Hr ___48 Hr ___3 Day ___5 Day

TAT dependent on speed of microbial growth.

Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.

Special Instructions:

REQUESTED ANALYSIS

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

Client sample ID number (Sample ID's must be unique)	PLM - Short report, Point Count, Long report, Qualitative	TEM - AHERA, Level II, 7402, ISO, +/- (Air, Bulk or Dust), Quant, Semi-Quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan, pH	ORGANICS - METH, TSS	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Camphlobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantification	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/-, Identification, Quantification	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
1 RW31-0101	✓														B	1	4/27/16		1613933 ~~1613933~~ EN
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Number of samples received: 1 (Additional samples shall be listed on attached long form.)

NOTE: REI will analyze incoming samples based upon information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days, failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By: Tim Grenier Date/Time: 4/28/16 0942

Laboratory Use Only
Received By: Erica Mun Date/Time: 4.28.16 9:45 Carrier: Hand / FedEx / UPS / USPS / Drop Box / Courier

Sample Condition: On Ice Yes / No | Sealed Yes / No | Intact Yes / No
Temp. (F°) _____

Data Entry QA:	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials
	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials

Reservoirs Environmental, Inc.

March 15, 2016

Subcontract Number: **NA**
Laboratory Report: **RES 344322-1R**
Project # / P.O. # **11600702.2102**
Project Description: **None Given**

Pinyon Environmental Engineering
9100 West Jewell Ave. Suite 200
Lakewood CO 80232

Dear Customer,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA), Lab ID 101533 - Accreditation Certificate #480 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

RES 344322-1R is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,

Elisa Mari for

Jeanne Spencer
President

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 344322-1R**
Client: **Pinyon Environmental Engineering**
Client Project Number / P.O.: **11600702.2102**
Client Project Description: **None Given**
Date Samples Received: **March 04, 2016**
Method: **EPA 600/R-93/116 - Short Report, Bulk**
Turnaround: **3-5 Day**
Date Samples Analyzed: **March 15, 2016**

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
RW9SB01 (7.5-15)	EM 1583576	A	Gray granular plaster	40	**Chrysotile**	**TR**	0	100
		B	White plaster	60		**ND**	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

Anya Angst
Analyst

Liu Wenlong
Analyst / Data QA

Due Date: 3-9-11
Due Time: 4pm

Reservoirs Environmental, Inc.

5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

After Hours Cell Phone: 720-339-9228

RES 344322

SUBMITTED BY:

Company: Pinyon Env.
Address: 9100 W Jewell Ave
Lakewood, Co 80232
Project Number and/or P.O. #: 11600702.2102
Project Description/Location:

INVOICE TO: (IF DIFFERENT)

Company:
Address:

CONTACT INFORMATION:

Contact: Corinne Wardell
Phone: 303.980.5200
Fax:
Cell/pager:

Contact: Tim Grenier
Phone: 253.651.0352
Fax:
Cell/pager:

Final Data Deliverable Email Address: wardell@pinyon-env.com; grenier@pinyon-env.com

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm

PLM / PCM / TEM ____ RUSH (Same Day) ___ PRIORITY (Next Day) ✓ STANDARD (3-5 Day)
(Rush PCM = 2hr, TEM = 6hr.)

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm

Metal(s) / Dust** ___ RUSH ___ 24 hr. ___3-5 Day
RCRA 8 / Metals & Welding Fume Scan / TCLP** __RUSH (3 Day)__5 Day __10 Day
Organics ___ 24 hr. ___ 3 day ___5 Day

Prior notification is required for RUSH turnarounds.

MICROBIOLOGY LABORATORY HOURS: Weekdays: 8am - 5pm

E.coli and/or Coliforms* ___ 24-48 Hour Other: _____
Pathogens* ___ 24-48 Hour
Microbial Growth* ___ 5-10 Day
Legionella ___ 10 Day
Mold ___ RUSH ___24 Hr ___48 Hr ___3 Day ___5 Day

TAT dependent on speed of microbial growth.

Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.

Special Instructions:

REQUESTED ANALYSIS

PLM - Short report, Point Count, Long report, Qualitative	TEM - AHERA, Level II, 7402, ISO, +/- (Air, Bulk or Dust), Quant, Semi-Quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan, pH	ORGANICS - METH, TSS	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Camphlobacter: +/- or Quantification	E.coli and/or Coliforms: +/- or Quantification	Microbial Growth: Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification	Legionella: +/- or Quantification	Other: Bioburden, LAL or Environmental	Mold: Spore Trap or Bulk: +/-, Identification, Quantification	SAMPLER'S INITIALS OR OTHER NOTES:
✓												A

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

Client sample ID number (Sample ID's must be unique)	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
1 OTO1		B	1			1583576
2						
3						
4						
5						
6						
7						
8						
9						
10						

LAB NOTES:

Number of samples received: 1 (Additional samples shall be listed on attached long form.)

NOTE: REI will analyze incoming samples based upon information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days, failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By: _____ Date/Time: 3/4/16 1600

Laboratory Use Only
Received By: Nicole Date/Time: 3/4/16 4p Carrier: (Hand) / FedEx / UPS / USPS / Drop Box / Courier

Sample Condition: On Ice Yes / No; Sealed Yes / No; Intact (Yes) / No
Temp. (F°) _____

Data Entry QA:	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials
	Contact	Phone	Email	Fax	Date	Time	Initials	Contact	Phone	Email	Fax	Date	Time	Initials

ORIGINS LABORATORY, INC

May 12, 2016

Pinyon

Corinne Wardell

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

Project Name - Federal BLVD PH. II **Project Number - 11600702**

Attached are your analytical results for Federal BLVD PH. II received by Origins Laboratory, Inc. May 05, 2016. This project is associated with Origins project number X605064-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RW6GW01'	X605064-01	Water	May 4, 2016 13:00	05/05/2016 08:03
RW6GW02'	X605064-02	Water	May 4, 2016 14:00	05/05/2016 08:03
RW9GW01'	X605064-03	Water	May 4, 2016 15:00	05/05/2016 08:03
RW25GW01'	X605064-04	Water	May 4, 2016 17:00	05/05/2016 08:03
RW28GW01'	X605064-05	Water	May 4, 2016 18:00	05/05/2016 08:03
RW14GW02'	X605064-06	Water	May 4, 2016 16:00	05/05/2016 08:03
RW14GW01'	X605064-07	Water	May 4, 2016 19:00	05/05/2016 08:03
RW19GW01'	X605064-08	Water	May 4, 2016 18:30	05/05/2016 08:03

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

ORIGINS LABORATORY, INC

www.originslaboratory.com

X605064

page 1 of 1

Client: PINYON ENVIRONMENTAL
Address: 9100 W JEWELL AVE
LAKEWOOD CO 80232
Telephone Number: 303-980-5200
Email Address: WARDELL@PINYON-ENV.COM

Project Manager: CORINNE WARDELL
Project Name: FEDERAL BLVD PH. II
Project Number: 11600702
Samples Collected By: RMT

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative: Unpreserved	Preservative: HCl	Preservative: HNO_3	Preservative: Other	Matrix: Groundwater	Matrix: Soil	Matrix: Air Summa Canister #	Matrix: Other	Analysis: VOCs	Analysis: GRO/DRO	Analysis: DISS RCRA 8	Analysis: PAH	Sample Instructions	
RW6GW01	5/4/16	1300	9	x	x	x		x				x	x	x	x	-FIELD FILTERED	1
RW6GW02	5/4/16	1400	7	x	x	x		x				x	x	x		DISS RCRA 8	2
RW9GW01	5/4/16	1500	9	x	x	x		x				x	x	x	x	-FOR PAH ANALYSIS	3
RW25GW01	5/4/16	1700	9	x	x	x		x				x	x	x	x	SOME 2nd 1L AMBERS	4
RW28GW01	5/4/16	1800	9	x	x	x		x				x	x	x	x	ARE ½ FULL OR LABELED	5
RW14GW02	5/4/16	1600	9	x	x	x		x				x	x	x	x	"USE IF NEEDED", USE	6
RW14GW01	5/4/16	1900	7	x	+	x		x				x	x	x		THOSE BOTTLES IF NEEDED	7
RW19GW01	5/4/16	1830	9	x	x	x		x				x	x	x	x	FOR ANALYSIS ONLY.	8
																	9
																	10

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
[signature]	5/5/16	0800	[signature]	5/5/16	0803
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☒

Temp Received- 1.8°C

Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: X605064

Client: Pinyon
Client Project ID: Federal BLVD PH. II

Checklist Completed by: Jeff Smith
Date/time completed: 5/5/16

Shipped Via: HD (UPS, FedEx, Hand Delivered, Pick-up, etc.)
Airbill #: NA

Matrix(s) Received: (Check all that apply): _____Soil/Solid __X__Water _____Other:_____ (Describe)

Cooler Number/Temperature: 1 / 1.8 °C _____/_____ °C _____/_____ °C _____/_____ °C

Thermometer ID: T603

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]?	X			
Is there ice present (document if blue ice is used)	X			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		X		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		X		
Were all samples received intact[1]?	X			
Was adequate sample volume provided[1]?	X			
Are short holding time analytes or samples with HTs due within 48 hours present[1]?		X		
Is a chain-of-custody (COC) present and filled out completely[1]?	X			
Does the COC agree with the number and type of sample bottles received[1]?	X			
Do the sample IDs on the bottle labels match the COC[1]?	X			
Is the COC properly relinquished by the client with date and time recorded[1]?	X			
For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.**		X		
Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / (pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)*	X			HCl, HNO3
Additional Comments (if any):				

[1] *If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) — 5/10/16 Date/Time Reviewed

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW01'
5/4/2016 1:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-01 (Water)								
Dissolved Metals by 6010C								
Arsenic	**0.00695**	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	J
Barium	**0.0615**	0.005	"	"	"	"	"	
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.00164**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	**0.031**	0.030	"	"	"	"	"	
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*84.4 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW01'
5/4/2016 1:00:00PM

Origins Laboratory, Inc.
X605064-01 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,2-Trichloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
2-Butanone	ND	5.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW01'
5/4/2016 1:00:00PM

Origins Laboratory, Inc.
X605064-01 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Chlorotoluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW01'
5/4/2016 1:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X605064-01 (Water)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.0	"	"	"	"	"	Ua
Toluene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW01'
5/4/2016 1:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X605064-01 (Water)

VOC by EPA 8260C

trans-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*93.0 %*	*84-121*			"	"	"	
Surrogate: Toluene-d8	*102 %*	*85-115*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*110 %*	*84-114*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW02'
5/4/2016 2:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-02 (Water)								
Dissolved Metals by 6010C								
Arsenic	ND	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	U
Barium	**0.0281**	0.005	"	"	"	"	"	
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.00105**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	**0.042**	0.030	"	"	"	"	"	
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*78.3 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW02'
5/4/2016 2:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X605064-02 (Water)

VOC by EPA 8260C

1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,2-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW02'
5/4/2016 2:00:00PM

Origins Laboratory, Inc.
X605064-02 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Butanone	ND	5.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW02'
5/4/2016 2:00:00PM

Origins Laboratory, Inc.
X605064-02 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
cis-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW6GW02'
5/4/2016 2:00:00PM

Origins Laboratory, Inc.
X605064-02 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Toluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*96.0 %*	*84-121*			"	"	"	
Surrogate: Toluene-d8	*102 %*	*85-115*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*108 %*	*84-114*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW9GW01'
5/4/2016 3:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-03 (Water)								
Dissolved Metals by 6010C								
Arsenic	ND	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	U
Barium	**0.0604**	0.005	"	"	"	"	"	
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.00214**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	ND	0.030	"	"	"	"	"	U
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*73.2 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW9GW01'
5/4/2016 3:00:00PM

Origins Laboratory, Inc.
X605064-03 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,2-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW9GW01'
5/4/2016 3:00:00PM

Origins Laboratory, Inc.
X605064-03 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Butanone	ND	5.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW9GW01'
5/4/2016 3:00:00PM

Origins Laboratory, Inc.

X605064-03 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
cis-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW9GW01'
5/4/2016 3:00:00PM

Origins Laboratory, Inc.
X605064-03 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Toluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*96.3 %*	*84-121*			"	"	"	
Surrogate: Toluene-d8	*101 %*	*85-115*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*108 %*	*84-114*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW25GW01'
5/4/2016 5:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-04 (Water)								
Dissolved Metals by 6010C								
Arsenic	ND	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	U
Barium	**0.0279**	0.005	"	"	"	"	"	
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.0012**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	**0.00947**	0.030	"	"	"	"	"	J
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*71.1 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW25GW01'
5/4/2016 5:00:00PM

Origins Laboratory, Inc.
X605064-04 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,2-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW25GW01'
5/4/2016 5:00:00PM

Origins Laboratory, Inc.
X605064-04 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Butanone	ND	5.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW25GW01'
5/4/2016 5:00:00PM

Origins Laboratory, Inc.
X605064-04 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
cis-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW25GW01'
5/4/2016 5:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.
X605064-04 (Water)

VOC by EPA 8260C

Toluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*97.7 %*	*84-121*	"	"	"
Surrogate: Toluene-d8	*101 %*	*85-115*	"	"	"
Surrogate: 4-Bromofluorobenzene	*108 %*	*84-114*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW28GW01'
5/4/2016 6:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-05 (Water)								
Dissolved Metals by 6010C								
Arsenic	ND	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	U
Barium	**0.0265**	0.005	"	"	"	"	"	
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.00149**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	**0.0173**	0.030	"	"	"	"	"	J
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*78.5 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW28GW01'
5/4/2016 6:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X605064-05 (Water)

VOC by EPA 8260C

1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,2-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW28GW01'
5/4/2016 6:00:00PM

Origins Laboratory, Inc.
X605064-05 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Butanone	ND	5.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW28GW01'
5/4/2016 6:00:00PM

Origins Laboratory, Inc.

X605064-05 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
cis-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	**1.4**	1.0	"	"	"	"	"	

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW28GW01'
5/4/2016 6:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.
X605064-05 (Water)

VOC by EPA 8260C

Toluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*99.2 %*	*84-121*	"	"	"
Surrogate: Toluene-d8	*99.5 %*	*85-115*	"	"	"
Surrogate: 4-Bromofluorobenzene	*108 %*	*84-114*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW02'
5/4/2016 4:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-06 (Water)								
Dissolved Metals by 6010C								
Arsenic	**0.00684**	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	J
Barium	**0.0376**	0.005	"	"	"	"	"	
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.00206**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	ND	0.030	"	"	"	"	"	U
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*69.3 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW02'
5/4/2016 4:00:00PM

Origins Laboratory, Inc.
X605064-06 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,2-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW02'
5/4/2016 4:00:00PM

Origins Laboratory, Inc.
X605064-06 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Butanone	ND	5.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW02'
5/4/2016 4:00:00PM

Origins Laboratory, Inc.
X605064-06 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
cis-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW02'
5/4/2016 4:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X605064-06 (Water)

VOC by EPA 8260C

Toluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*96.8 %*	*84-121*	"	"	"
Surrogate: Toluene-d8	*101 %*	*85-115*	"	"	"
Surrogate: 4-Bromofluorobenzene	*110 %*	*84-114*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW01'
5/4/2016 7:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-07 (Water)								
Dissolved Metals by 6010C								
Arsenic	ND	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	U
Barium	**0.0386**	0.005	"	"	"	"	"	
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.00127**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	**0.00954**	0.030	"	"	"	"	"	J
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*81.5 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW01'
5/4/2016 7:00:00PM

Origins Laboratory, Inc.
X605064-07 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,2-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW01'
5/4/2016 7:00:00PM

Origins Laboratory, Inc.
X605064-07 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Butanone	ND	5.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW01'
5/4/2016 7:00:00PM

Origins Laboratory, Inc.
X605064-07 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
cis-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW14GW01'
5/4/2016 7:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.
X605064-07 (Water)

VOC by EPA 8260C

Toluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*96.9 %*	*84-121*	"	"	"
Surrogate: Toluene-d8	*101 %*	*85-115*	"	"	"
Surrogate: 4-Bromofluorobenzene	*109 %*	*84-114*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW19GW01'
5/4/2016 6:30:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC								
X605064-08 (Water)								
Dissolved Metals by 6010C								
Arsenic	ND	0.030	mg/L	1	1565425	05/06/2016	05/09/2016	U
Barium	**0.00965**	0.005	"	"	"	"	"	J
Cadmium	ND	0.005	"	"	"	"	"	U
Chromium	**0.00132**	0.005	"	"	"	"	"	J
Lead	ND	0.010	"	"	"	"	"	U
Selenium	ND	0.030	"	"	"	"	"	U
Silver	ND	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A								
Mercury	ND	0.0002	mg/L	1	1565331	"	05/09/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C								
Gasoline (C6-C10)	ND	5.0	mg/L	1	B6E0906	05/09/2016	05/11/2016	Ua
Diesel (C10-C28)	ND	5.0	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*75.4 %*	*54-117*			"	"	"	
VOC by EPA 8260C								
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,1-Trichloroethane	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW19GW01'
5/4/2016 6:30:00PM

Origins Laboratory, Inc.

X605064-08 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
1,1,2-Trichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.0	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.0	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.0	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.0	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.0	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.0	"	"	"	"	"	Ua

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW19GW01'
5/4/2016 6:30:00PM

Origins Laboratory, Inc.

X605064-08 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
2-Butanone	ND	5.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
2-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
2-Hexanone	ND	5.0	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.0	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.0	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.0	"	"	"	"	"	Ua
Acetone	ND	8.0	"	"	"	"	"	Ua
Benzene	ND	1.0	"	"	"	"	"	Ua
Bromobenzene	ND	1.0	"	"	"	"	"	Ua
Bromochloromethane	ND	1.0	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.0	"	"	"	"	"	Ua
Bromoform	ND	1.0	"	"	"	"	"	Ua
Bromomethane	ND	1.0	"	"	"	"	"	Ua
Carbon disulfide	ND	5.0	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.0	"	"	"	"	"	Ua
Chlorobenzene	ND	1.0	"	"	"	"	"	Ua
Chloroethane	ND	1.0	"	"	"	"	"	Ua
Chloroform	ND	1.0	"	"	"	"	"	Ua
Chloromethane	ND	1.0	"	"	"	"	"	Ua

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW19GW01'
5/4/2016 6:30:00PM

Origins Laboratory, Inc.
X605064-08 (Water)

VOC by EPA 8260C

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
cis-1,2-Dichloroethene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
cis-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.0	"	"	"	"	"	Ua
Dibromomethane	ND	1.0	"	"	"	"	"	Ua
Ethylbenzene	ND	1.0	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.0	"	"	"	"	"	Ua
Iodomethane	ND	10	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.0	"	"	"	"	"	Ua
m,p-Xylene	ND	2.0	"	"	"	"	"	Ua
Methylene Chloride	ND	5.0	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.0	"	"	"	"	"	Ua
Naphthalene	ND	4.0	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.0	"	"	"	"	"	Ua
o-Xylene	ND	1.0	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Styrene	ND	1.0	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.0	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.0	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

RW19GW01'
5/4/2016 6:30:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.
X605064-08 (Water)

VOC by EPA 8260C

Toluene	ND	1.0	ug/L	1	B6E0601	05/06/2016	05/06/2016	Ua
trans-1,2-Dichloroethene	ND	1.0	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.0	"	"	"	"	"	Ua
Trichloroethene	ND	1.0	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.0	"	"	"	"	"	Ua
Vinyl chloride	ND	1.0	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*98.4 %*	*84-121*	"	"	"
Surrogate: Toluene-d8	*100 %*	*85-115*	"	"	"
Surrogate: 4-Bromofluorobenzene	*110 %*	*84-114*	"	"	"

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Blank (B6E0601-BLK1)				Prepared: 05/06/2016 Analyzed: 05/06/2016						
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L							Ua
1,1,1-Trichloroethane	ND	1.0	"							Ua
1,1,2,2-Tetrachloroethane	ND	1.0	"							Ua
1,1,2-Trichloroethane	ND	1.0	"							Ua
1,1-Dichloroethane	ND	1.0	"							Ua
1,1-Dichloroethene	ND	1.0	"							Ua
1,1-Dichloropropene	ND	1.0	"							Ua
1,2,3-Trichlorobenzene	ND	5.0	"							Ua
1,2,3-Trichloropropane	ND	5.0	"							Ua
1,2,4-Trichlorobenzene	ND	5.0	"							Ua
1,2,4-Trimethylbenzene	ND	1.0	"							Ua
1,2-Dibromo-3-chloropropane	ND	5.0	"							Ua
1,2-Dibromoethane (EDB)	ND	1.0	"							Ua
1,2-Dichlorobenzene	ND	1.0	"							Ua
1,2-Dichloroethane	ND	1.0	"							Ua
1,2-Dichloropropane	ND	1.0	"							Ua
1,3,5-Trimethylbenzene	ND	1.0	"							Ua
1,3-Dichlorobenzene	ND	1.0	"							Ua
1,3-Dichloropropane	ND	1.0	"							Ua
1,4-Dichlorobenzene	ND	1.0	"							Ua
2,2-Dichloropropane	ND	1.0	"							Ua
2-Butanone	ND	5.0	"							Ua
2-Chlorotoluene	ND	1.0	"							Ua
2-Hexanone	ND	5.0	"							Ua
4-Chlorotoluene	ND	1.0	"							Ua
4-Isopropyltoluene	ND	1.0	"							Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Blank (B6E0601-BLK1)				Prepared: 05/06/2016 Analyzed: 05/06/2016						
4-Methyl-2-pentanone	ND	5.0	ug/L							Ua
Acetone	ND	8.0	"							Ua
Benzene	ND	1.0	"							Ua
Bromobenzene	ND	1.0	"							Ua
Bromochloromethane	ND	1.0	"							Ua
Bromodichloromethane	ND	1.0	"							Ua
Bromoform	ND	1.0	"							Ua
Bromomethane	ND	1.0	"							Ua
Carbon disulfide	ND	5.0	"							Ua
Carbon tetrachloride	ND	1.0	"							Ua
Chlorobenzene	ND	1.0	"							Ua
Chloroethane	ND	1.0	"							Ua
Chloroform	ND	1.0	"							Ua
Chloromethane	ND	1.0	"							Ua
cis-1,2-Dichloroethene	ND	1.0	"							Ua
cis-1,3-Dichloropropene	ND	1.0	"							Ua
Dibromochloromethane	ND	1.0	"							Ua
Dibromomethane	ND	1.0	"							Ua
Ethylbenzene	ND	1.0	"							Ua
Hexachlorobutadiene	ND	5.0	"							Ua
Iodomethane	ND	10	"							Ua
Isopropylbenzene	ND	1.0	"							Ua
m,p-Xylene	ND	2.0	"							Ua
Methylene Chloride	ND	5.0	"							Ua
Methyl tert-Butyl Ether	ND	1.0	"							Ua
Naphthalene	ND	4.0	"							Ua

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Blank (B6E0601-BLK1)					Prepared: 05/06/2016 Analyzed: 05/06/2016					
n-Butylbenzene	ND	1.0	ug/L							Ua
n-Propylbenzene	ND	1.0	"							Ua
o-Xylene	ND	1.0	"							Ua
sec-Butylbenzene	ND	1.0	"							Ua
Styrene	ND	1.0	"							Ua
tert-Butylbenzene	ND	1.0	"							Ua
Tetrachloroethene	ND	1.0	"							Ua
Toluene	ND	1.0	"							Ua
trans-1,2-Dichloroethene	ND	1.0	"							Ua
trans-1,3-Dichloropropene	ND	1.0	"							Ua
Trichloroethene	ND	1.0	"							Ua
Trichlorofluoromethane	ND	1.0	"							Ua
Vinyl chloride	ND	1.0	"							Ua
Surrogate: 1,2-Dichloroethane-d4	*62*		"	*62.5*		*98.9*	*84-121*			
Surrogate: Toluene-d8	*62*		"	*62.5*		*98.9*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*68*		"	*62.5*		*109*	*84-114*			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
LCS (B6E0601-BS1)					Prepared: 05/06/2016 Analyzed: 05/06/2016					
1,1,1,2-Tetrachloroethane	47	1.0	ug/L	50.0		94.4	78.8-128			
1,1,1-Trichloroethane	46	1.0	"	50.0		92.9	82.3-118			
1,1,2,2-Tetrachloroethane	55	1.0	"	50.0		111	67.9-119			
1,1,2-Trichloroethane	50	1.0	"	50.0		99.7	75.4-116			
1,1-Dichloroethane	50	1.0	"	50.0		101	81.1-113			
1,1-Dichloroethene	52	1.0	"	50.0		104	79.4-118			
1,1-Dichloropropene	47	1.0	"	50.0		94.8	78-120			
1,2,3-Trichlorobenzene	58	5.0	"	50.0		116	63.8-134			
1,2,3-Trichloropropane	50	5.0	"	50.0		99.0	63.3-121			
1,2,4-Trichlorobenzene	47	5.0	"	50.0		94.5	70.4-125			
1,2,4-Trimethylbenzene	48	1.0	"	50.0		95.5	73.3-123			
1,2-Dibromo-3-chloropropane	52	5.0	"	50.0		104	71.6-114			
1,2-Dibromoethane (EDB)	50	1.0	"	50.0		100	74.7-127			
1,2-Dichlorobenzene	49	1.0	"	50.0		97.8	81.3-116			
1,2-Dichloroethane	47	1.0	"	50.0		93.6	71.1-120			
1,2-Dichloropropane	48	1.0	"	50.0		95.2	77.4-115			
1,3,5-Trimethylbenzene	48	1.0	"	50.0		96.6	71.9-128			
1,3-Dichlorobenzene	52	1.0	"	50.0		104	82.1-117			
1,3-Dichloropropane	50	1.0	"	50.0		99.7	75.1-123			
1,4-Dichlorobenzene	50	1.0	"	50.0		101	76.8-119			
2,2-Dichloropropane	48	1.0	"	50.0		95.7	84-120			
2-Butanone	250	5.0	"	250		99.7	64.9-123			
2-Chlorotoluene	55	1.0	"	50.0		109	66-133			
2-Hexanone	250	5.0	"	250		99.6	70.9-116			
4-Chlorotoluene	53	1.0	"	50.0		107	73.2-119			
4-Isopropyltoluene	49	1.0	"	50.0		98.5	79.8-120			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
LCS (B6E0601-BS1)					Prepared: 05/06/2016 Analyzed: 05/06/2016					
4-Methyl-2-pentanone	260	5.0	ug/L	250		103	58.5-122			
Acetone	240	8.0	"	250		96.2	65.4-125			
Benzene	50	1.0	"	50.0		101	75.5-116			
Bromobenzene	52	1.0	"	50.0		104	70-130			
Bromochloromethane	48	1.0	"	50.0		95.8	79-115			
Bromodichloromethane	48	1.0	"	50.0		95.4	73-123			
Bromoform	46	1.0	"	50.0		91.4	75-128			
Bromomethane	51	1.0	"	50.0		102	72-138			
Carbon disulfide	64	5.0	"	50.0		128	69-129			
Carbon tetrachloride	43	1.0	"	50.0		86.4	80-124			
Chlorobenzene	51	1.0	"	50.0		102	78-121			
Chloroethane	48	1.0	"	50.0		95.6	77-138			
Chloroform	49	1.0	"	50.0		97.4	75-117			
Chloromethane	49	1.0	"	50.0		97.0	72-130			
cis-1,2-Dichloroethene	49	1.0	"	50.0		97.8	78-118			
cis-1,3-Dichloropropene	50	1.0	"	50.0		100	73-122			
Dibromochloromethane	46	1.0	"	50.0		92.0	78-119			
Dibromomethane	47	1.0	"	50.0		93.4	79-116			
Ethylbenzene	50	1.0	"	50.0		100	78-130			
Hexachlorobutadiene	52	5.0	"	50.0		103	72-129			
Iodomethane	74	10	"	50.0		148	74-121			QM-11
Isopropylbenzene	49	1.0	"	50.0		98.3	75-128			
m,p-Xylene	100	2.0	"	100		103	75-134			
Methylene Chloride	52	5.0	"	50.0		103	80-122			
Methyl tert-Butyl Ether	50	1.0	"	50.0		101	72-125			
Naphthalene	49	4.0	"	50.0		98.2	65-128			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
LCS (B6E0601-BS1)					Prepared: 05/06/2016 Analyzed: 05/06/2016					
n-Butylbenzene	49	1.0	ug/L	50.0		97.4	69-134			
n-Propylbenzene	51	1.0	"	50.0		103	74-132			
o-Xylene	55	1.0	"	50.0		110	76-129			
sec-Butylbenzene	51	1.0	"	50.0		102	74-128			
Styrene	55	1.0	"	50.0		110	74-126			
tert-Butylbenzene	46	1.0	"	50.0		92.4	72-123			
Tetrachloroethene	43	1.0	"	50.0		86.0	78-132			
Toluene	53	1.0	"	50.0		107	76-128			
trans-1,2-Dichloroethene	51	1.0	"	50.0		102	79-120			
trans-1,3-Dichloropropene	50	1.0	"	50.0		100	74-122			
Trichloroethene	46	1.0	"	50.0		92.0	76-125			
Trichlorofluoromethane	49	1.0	"	50.0		97.4	66-149			
Vinyl chloride	53	1.0	"	50.0		107	70-137			
Surrogate: 1,2-Dichloroethane-d4	*63*		"	*62.5*		*101*	*84-121*			
Surrogate: Toluene-d8	*63*		"	*62.5*		*100*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*64*		"	*62.5*		*102*	*84-114*			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Matrix Spike (B6E0601-MS1)		**Source: X605069-01**			Prepared: 05/06/2016 Analyzed: 05/06/2016					
1,1,1,2-Tetrachloroethane	48	1.0	ug/L	50.0	ND	96.4	82-130			
1,1,1-Trichloroethane	48	1.0	"	50.0	ND	95.4	81-125			
1,1,2,2-Tetrachloroethane	48	1.0	"	50.0	ND	96.1	74-120			
1,1,2-Trichloroethane	51	1.0	"	50.0	ND	102	80-118			
1,1-Dichloroethane	52	1.0	"	50.0	ND	104	79-120			
1,1-Dichloroethene	53	1.0	"	50.0	ND	107	73-130			
1,1-Dichloropropene	49	1.0	"	50.0	ND	97.4	77-124			
1,2,3-Trichlorobenzene	59	5.0	"	50.0	ND	118	55-144			
1,2,3-Trichloropropane	50	5.0	"	50.0	ND	101	67-126			
1,2,4-Trichlorobenzene	48	5.0	"	50.0	0.5	95.4	56-141			
1,2,4-Trimethylbenzene	50	1.0	"	50.0	0.4	98.7	62-132			
1,2-Dibromo-3-chloropropane	51	5.0	"	50.0	ND	102	56-142			
1,2-Dibromoethane (EDB)	52	1.0	"	50.0	ND	104	84-124			
1,2-Dichlorobenzene	50	1.0	"	50.0	ND	101	74-124			
1,2-Dichloroethane	49	1.0	"	50.0	ND	97.5	76-120			
1,2-Dichloropropane	50	1.0	"	50.0	ND	99.5	78-117			
1,3,5-Trimethylbenzene	49	1.0	"	50.0	0.2	98.3	64-138			
1,3-Dichlorobenzene	54	1.0	"	50.0	ND	107	73-126			
1,3-Dichloropropane	52	1.0	"	50.0	ND	103	83-120			
1,4-Dichlorobenzene	52	1.0	"	50.0	ND	104	64-130			
2,2-Dichloropropane	49	1.0	"	50.0	ND	98.5	77-129			
2-Butanone	270	5.0	"	250	ND	107	66-128			
2-Chlorotoluene	57	1.0	"	50.0	ND	113	71-130			
2-Hexanone	270	5.0	"	250	ND	107	74-123			
4-Chlorotoluene	55	1.0	"	50.0	ND	110	66-128			
4-Isopropyltoluene	50	1.0	"	50.0	0.3	100	60-140			

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Matrix Spike (B6E0601-MS1)		**Source: X605069-01**			Prepared: 05/06/2016 Analyzed: 05/06/2016					
4-Methyl-2-pentanone	270	5.0	ug/L	250	ND	107	65-125			
Acetone	260	8.0	"	250	ND	106	63-134			
Benzene	52	1.0	"	50.0	ND	103	74-130			
Bromobenzene	54	1.0	"	50.0	ND	108	70-130			
Bromochloromethane	50	1.0	"	50.0	ND	100	80-118			
Bromodichloromethane	49	1.0	"	50.0	ND	98.5	76-122			
Bromoform	47	1.0	"	50.0	ND	93.7	80-128			
Bromomethane	52	1.0	"	50.0	ND	104	69-144			
Carbon disulfide	66	5.0	"	50.0	ND	131	70-131			
Carbon tetrachloride	44	1.0	"	50.0	ND	88.1	81-130			
Chlorobenzene	53	1.0	"	50.0	ND	105	72-128			
Chloroethane	49	1.0	"	50.0	ND	97.7	79-140			
Chloroform	51	1.0	"	50.0	ND	102	76-118			
Chloromethane	50	1.0	"	50.0	ND	99.8	72-128			
cis-1,2-Dichloroethene	51	1.0	"	50.0	ND	102	78-120			
cis-1,3-Dichloropropene	51	1.0	"	50.0	ND	102	79-120			
Dibromochloromethane	48	1.0	"	50.0	ND	95.1	81-121			
Dibromomethane	48	1.0	"	50.0	ND	95.6	84-115			
Ethylbenzene	51	1.0	"	50.0	ND	103	76-132			
Hexachlorobutadiene	52	5.0	"	50.0	ND	103	70-130			
Iodomethane	76	10	"	50.0	ND	153	72-127			QM-07
Isopropylbenzene	50	1.0	"	50.0	ND	100	66-135			
m,p-Xylene	110	2.0	"	100	ND	105	69-139			
Methylene Chloride	44	5.0	"	50.0	ND	88.7	87-118			
Methyl tert-Butyl Ether	55	1.0	"	50.0	1.8	106	62-138			
Naphthalene	50	4.0	"	50.0	ND	101	59-148			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Matrix Spike (B6E0601-MS1)		**Source: X605069-01**			Prepared: 05/06/2016 Analyzed: 05/06/2016					
n-Butylbenzene	49	1.0	ug/L	50.0	0.3	97.6	52-146			
n-Propylbenzene	53	1.0	"	50.0	ND	106	66-141			
o-Xylene	56	1.0	"	50.0	ND	113	74-131			
sec-Butylbenzene	52	1.0	"	50.0	ND	104	63-138			
Styrene	57	1.0	"	50.0	ND	114	72-128			
tert-Butylbenzene	47	1.0	"	50.0	ND	94.9	67-129			
Tetrachloroethene	44	1.0	"	50.0	ND	88.8	76-134			
Toluene	55	1.0	"	50.0	ND	111	73-131			
trans-1,2-Dichloroethene	52	1.0	"	50.0	ND	104	78-123			
trans-1,3-Dichloropropene	51	1.0	"	50.0	ND	102	75-125			
Trichloroethene	48	1.0	"	50.0	ND	96.6	73-131			
Trichlorofluoromethane	50	1.0	"	50.0	ND	99.5	83-141			
Vinyl chloride	55	1.0	"	50.0	ND	110	73-139			
Surrogate: 1,2-Dichloroethane-d4	*65*		"	*62.5*		*104*	*84-121*			
Surrogate: Toluene-d8	*62*		"	*62.5*		*99.2*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*64*		"	*62.5*		*103*	*84-114*			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Matrix Spike Dup (B6E0601-MSD1)		**Source: X605069-01**			Prepared: 05/06/2016 Analyzed: 05/06/2016					
1,1,1,2-Tetrachloroethane	49	1.0	ug/L	50.0	ND	97.2	82-130	0.765	20	
1,1,1-Trichloroethane	49	1.0	"	50.0	ND	97.5	81-125	2.22	20	
1,1,2,2-Tetrachloroethane	48	1.0	"	50.0	ND	95.5	74-120	0.543	20	
1,1,2-Trichloroethane	52	1.0	"	50.0	ND	103	80-118	1.64	20	
1,1-Dichloroethane	52	1.0	"	50.0	ND	104	79-120	0.00	20	
1,1-Dichloroethene	55	1.0	"	50.0	ND	110	73-130	2.79	20	
1,1-Dichloropropene	50	1.0	"	50.0	ND	99.5	77-124	2.15	20	
1,2,3-Trichlorobenzene	59	5.0	"	50.0	ND	117	55-144	0.798	20	
1,2,3-Trichloropropane	47	5.0	"	50.0	ND	94.9	67-126	5.99	20	
1,2,4-Trichlorobenzene	49	5.0	"	50.0	0.5	96.1	56-141	0.662	20	
1,2,4-Trimethylbenzene	50	1.0	"	50.0	0.4	99.1	62-132	0.401	20	
1,2-Dibromo-3-chloropropane	49	5.0	"	50.0	ND	97.6	56-142	3.94	20	
1,2-Dibromoethane (EDB)	50	1.0	"	50.0	ND	100	84-124	3.55	20	
1,2-Dichlorobenzene	50	1.0	"	50.0	ND	99.8	74-124	0.818	20	
1,2-Dichloroethane	48	1.0	"	50.0	ND	95.1	76-120	2.49	20	
1,2-Dichloropropane	49	1.0	"	50.0	ND	99.0	78-117	0.484	20	
1,3,5-Trimethylbenzene	50	1.0	"	50.0	0.2	99.7	64-138	1.41	20	
1,3-Dichlorobenzene	54	1.0	"	50.0	ND	108	73-126	0.760	20	
1,3-Dichloropropane	50	1.0	"	50.0	ND	100	83-120	3.11	20	
1,4-Dichlorobenzene	52	1.0	"	50.0	ND	105	64-130	0.768	20	
2,2-Dichloropropane	51	1.0	"	50.0	ND	101	77-129	2.78	20	
2-Butanone	250	5.0	"	250	ND	102	66-128	5.30	20	
2-Chlorotoluene	57	1.0	"	50.0	ND	113	71-130	0.0706	20	
2-Hexanone	250	5.0	"	250	ND	102	74-123	4.81	20	
4-Chlorotoluene	56	1.0	"	50.0	ND	111	66-128	1.27	20	
4-Isopropyltoluene	52	1.0	"	50.0	0.3	102	60-140	2.08	20	

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Matrix Spike Dup (B6E0601-MSD1)		**Source: X605069-01**			Prepared: 05/06/2016 Analyzed: 05/06/2016					
4-Methyl-2-pentanone	260	5.0	ug/L	250	ND	102	65-125	4.40	20	
Acetone	250	8.0	"	250	ND	102	63-134	3.84	20	
Benzene	52	1.0	"	50.0	ND	104	74-130	0.522	20	
Bromobenzene	53	1.0	"	50.0	ND	106	70-130	1.66	20	
Bromochloromethane	49	1.0	"	50.0	ND	98.2	80-118	2.19	20	
Bromodichloromethane	49	1.0	"	50.0	ND	98.2	76-122	0.366	20	
Bromoform	46	1.0	"	50.0	ND	92.4	80-128	1.38	20	
Bromomethane	52	1.0	"	50.0	ND	103	69-144	0.809	20	
Carbon disulfide	67	5.0	"	50.0	ND	135	70-131	2.42	20	
Carbon tetrachloride	46	1.0	"	50.0	ND	91.2	81-130	3.39	20	
Chlorobenzene	52	1.0	"	50.0	ND	105	72-128	0.456	20	
Chloroethane	49	1.0	"	50.0	ND	98.7	79-140	0.957	20	
Chloroform	51	1.0	"	50.0	ND	101	76-118	0.197	20	
Chloromethane	49	1.0	"	50.0	ND	97.5	72-128	2.37	20	
cis-1,2-Dichloroethene	51	1.0	"	50.0	ND	102	78-120	0.216	20	
cis-1,3-Dichloropropene	50	1.0	"	50.0	ND	101	79-120	1.45	20	
Dibromochloromethane	47	1.0	"	50.0	ND	93.0	81-121	2.23	20	
Dibromomethane	46	1.0	"	50.0	ND	91.6	84-115	4.27	20	
Ethylbenzene	53	1.0	"	50.0	ND	105	76-132	2.25	20	
Hexachlorobutadiene	53	5.0	"	50.0	ND	105	70-130	2.04	20	
Iodomethane	77	10	"	50.0	ND	155	72-127	1.30	20	QM-07
Isopropylbenzene	51	1.0	"	50.0	ND	102	66-135	1.91	20	
m,p-Xylene	110	2.0	"	100	ND	108	69-139	2.19	20	
Methylene Chloride	44	5.0	"	50.0	ND	87.4	87-118	1.54	20	
Methyl tert-Butyl Ether	53	1.0	"	50.0	1.8	103	62-138	3.23	20	
Naphthalene	50	4.0	"	50.0	ND	99.9	59-148	0.937	20	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0601 - EPA 5030B (Water)										
Matrix Spike Dup (B6E0601-MSD1)		**Source: X605069-01**			Prepared: 05/06/2016 Analyzed: 05/06/2016					
n-Butylbenzene	50	1.0	ug/L	50.0	0.3	100	52-146	2.75	20	
n-Propylbenzene	54	1.0	"	50.0	ND	108	66-141	2.08	20	
o-Xylene	57	1.0	"	50.0	ND	114	74-131	0.759	20	
sec-Butylbenzene	53	1.0	"	50.0	ND	106	63-138	2.09	20	
Styrene	57	1.0	"	50.0	ND	114	72-128	0.562	20	
tert-Butylbenzene	48	1.0	"	50.0	ND	96.8	67-129	2.00	20	
Tetrachloroethene	46	1.0	"	50.0	ND	91.0	76-134	2.51	20	
Toluene	56	1.0	"	50.0	ND	112	73-131	1.02	20	
trans-1,2-Dichloroethene	53	1.0	"	50.0	ND	107	78-123	2.35	20	
trans-1,3-Dichloropropene	50	1.0	"	50.0	ND	101	75-125	1.45	20	
Trichloroethene	49	1.0	"	50.0	ND	98.7	73-131	2.19	20	
Trichlorofluoromethane	50	1.0	"	50.0	ND	99.2	83-141	0.342	20	
Vinyl chloride	54	1.0	"	50.0	ND	108	73-139	1.58	20	
Surrogate: 1,2-Dichloroethane-d4	*65*		*"*	*62.5*		*104*	*84-121*			
Surrogate: Toluene-d8	*62*		*"*	*62.5*		*99.3*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*64*		*"*	*62.5*		*103*	*84-114*			

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6E0906 - EPA 3511 Mod.										
Blank (B6E0906-BLK1)					Prepared: 05/09/2016 Analyzed: 05/11/2016					
Gasoline (C6-C10)	ND	5.0	mg/L							Ua
Diesel (C10-C28)	ND	5.0	"							Ua
Surrogate: o-Terphenyl	*5.1*		*"*	*5.00*		*103*	*54-117*			
LCS (B6E0906-BS1)					Prepared: 05/09/2016 Analyzed: 05/11/2016					
Gasoline (C6-C10)	88.4	5.0	mg/L	100		88.4	69-125			
Diesel (C10-C28)	92.9	5.0	"	100		92.9	61-120			
Surrogate: o-Terphenyl	*4.5*		*"*	*5.00*		*89.3*	*54-117*			
Matrix Spike (B6E0906-MS1)		**Source: X605077-03**			Prepared: 05/09/2016 Analyzed: 05/11/2016					
Gasoline (C6-C10)	96.8	5.0	mg/L	100	ND	96.8	70-127			
Diesel (C10-C28)	216	5.0	"	100	140	75.5	54-126			
Surrogate: o-Terphenyl	*4.1*		*"*	*5.00*		*82.0*	*54-117*			
Matrix Spike Dup (B6E0906-MSD1)		**Source: X605077-03**			Prepared: 05/09/2016 Analyzed: 05/11/2016					
Gasoline (C6-C10)	98.6	5.0	mg/L	100	ND	98.6	70-127	1.87	20	
Diesel (C10-C28)	243	5.0	"	100	140	103	54-126	11.9	20	
Surrogate: o-Terphenyl	*5.4*		*"*	*5.00*		*108*	*54-117*			

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Dissolved Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1565425 - SW846 3005A										
BLANK (1203543564-BLK)					Prepared: 05/06/2016 Analyzed: 05/09/2016					
Arsenic	ND	0.030	mg/L				-			U
Silver	ND	0.005	"				-			U
Selenium	ND	0.030	"				-			U
Barium	ND	0.005	"				-			U
Cadmium	ND	0.005	"				-			U
Chromium	ND	0.005	"				-			U
Lead	ND	0.010	"				-			U
LCS (1203543565-BKS)					Prepared: 05/06/2016 Analyzed: 05/09/2016					
Selenium	0.483	0.030	mg/L	0.500		96.6	80-120			
Barium	0.484	0.005	"	0.500		96.9	80-120			
Silver	0.490	0.005	"	0.500		98.1	80-120			
Lead	0.503	0.010	"	0.500		101	80-120			
Arsenic	0.502	0.030	"	0.500		100	80-120			
Chromium	0.496	0.005	"	0.500		99.2	80-120			
Cadmium	0.491	0.005	"	0.500		98.2	80-120			
DUP (1203543566 D)		**Source: X605064-01**			Prepared: 05/06/2016 Analyzed: 05/09/2016					
Chromium	0.00244	0.005	mg/L		0.00164		0-20	39.5	20	J
Silver	ND	0.005	"		<0.001		0-20	56	20	U
Lead	ND	0.010	"		<0.0033		0-20	97.1	20	U
Cadmium	ND	0.005	"		<0.001		0-20	50.1	20	U
Barium	0.0617	0.005	"		0.0615		0-20	0.279	20	
Arsenic	ND	0.030	"		0.00695		0-20	126	20	U
Selenium	0.0403	0.030	"		0.031		0-20	26.1	20	
MS (1203543567 S)		**Source: X605064-01**			Prepared: 05/06/2016 Analyzed: 05/09/2016					

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Dissolved Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1565425 - SW846 3005A										
MS (1203543567 S)		**Source: X605064-01**			Prepared: 05/06/2016 Analyzed: 05/09/2016					
Silver	0.482	0.005	mg/L	0.500	<0.001	96.3	75-125			
Arsenic	0.521	0.030	"	0.500	0.00695	103	75-125			
Barium	0.516	0.005	"	0.500	0.0615	90.9	75-125			
Cadmium	0.468	0.005	"	0.500	<0.001	93.5	75-125			
Chromium	0.475	0.005	"	0.500	0.00164	94.7	75-125			
Lead	0.467	0.010	"	0.500	<0.0033	93.3	75-125			
Selenium	0.522	0.030	"	0.500	0.031	98.2	75-125			

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Dissolved Metals by 7470A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1565331 - SW846 7470A Prep										
BLANK (1203543271-BLK)					Prepared: 05/06/2016 Analyzed: 05/09/2016					
Mercury	ND	0.0002	mg/L				-			U
LCS (1203543272-BKS)					Prepared: 05/06/2016 Analyzed: 05/09/2016					
Mercury	0.00193	0.0002	mg/L	0.002		96.7	80-120			

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: Federal BLVD PH. II

Notes and Definitions

Ua	Sample is Non-Detect.
U	Result not detected above the detection limit
QM-11	Spike recovery was outside acceptance limits for LCS, however samples are non-detect for this compound.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Greater than the detection limit but less than the reporting limit
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

June 28, 2016

Pinyon

Corinne Wardell

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

Project Name - CCOD Federal **Project Number - 11600702**

Attached are your analytical results for CCOD Federal received by Origins Laboratory, Inc. June 16, 2016. This project is associated with Origins project number X606221-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
RW2GW01	X606221-01	Water	June 16, 2016 14:00	06/16/2016 16:25
RW2GW02	X606221-02	Water	June 16, 2016 11:00	06/16/2016 16:25
RW2GW03	X606221-03	Water	June 16, 2016 11:30	06/16/2016 16:25
RW2GW04	X606221-04	Water	June 16, 2016 13:30	06/16/2016 16:25
RW2GW05	X606221-05	Water	June 16, 2016 12:00	06/16/2016 16:25

Per the email from Corinne on 06/28/16, the sample IDs for 03, 04, and 05 have been chaged to start with RW2.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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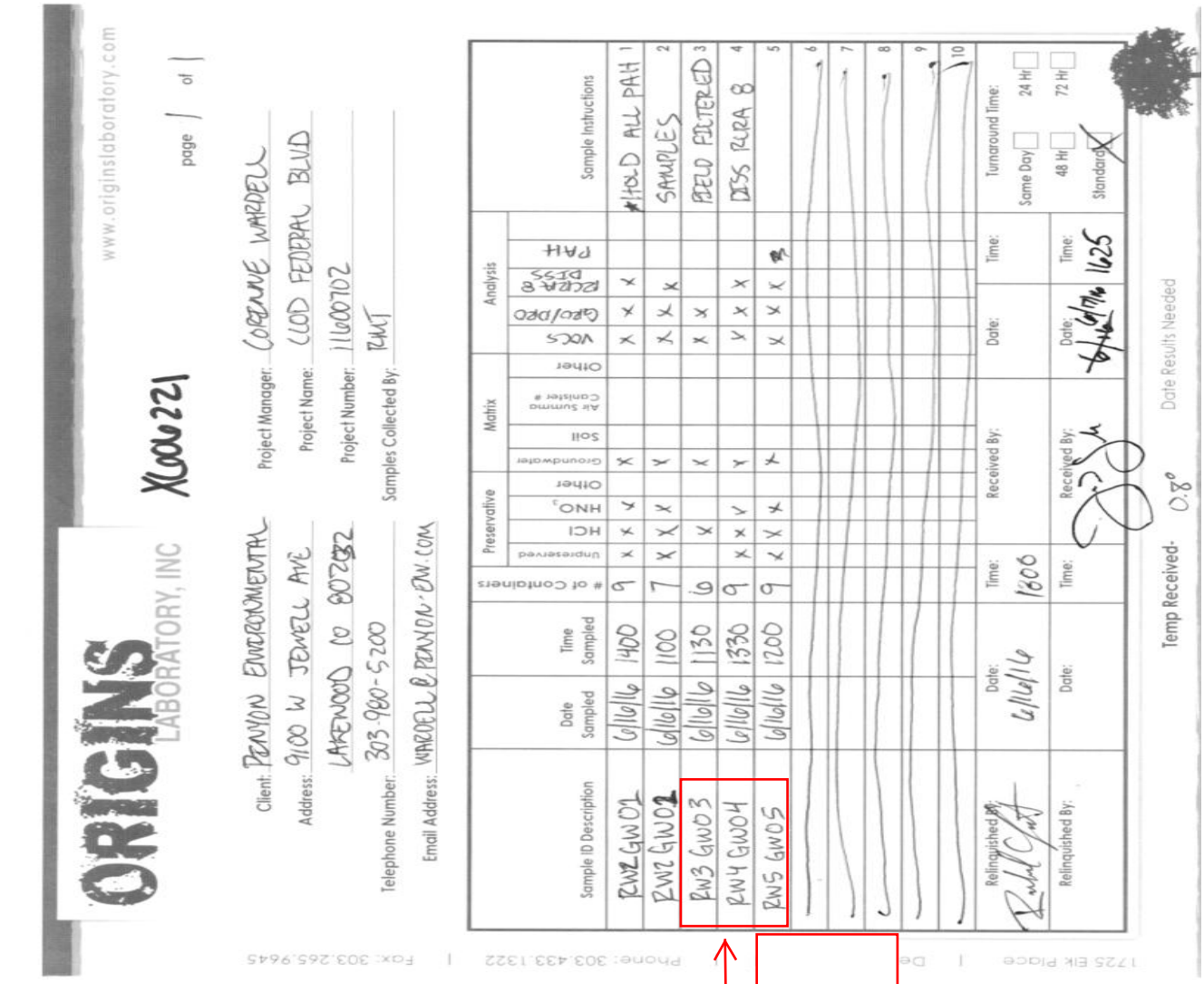
ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal



Sample IDs are:
RW2GW03
RW2GW04
RW2GW05

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: X1606221

Client: Pinyon
Client Project ID: CCOD Federal Blvd

Checklist Completed by: Jake Smith
Shipped Via: HD (UPS, FedEx, Hand Delivered, Pick-up, etc.)
Date/time completed: 6/21/16
Airbill #: N/A

Matrix(s) Received: (Check all that apply): ____Soil/Solid Y Water ____Other:____

Cooler Number/Temperature: 1 / 0.8 °C ____/____°C ____/____°C ____/____°C (Describe)

Thermometer ID: TT03

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]?	✓			
Is there ice present (document if blue ice is used)	✓			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		✓		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		✓		
Were all samples received intact[1]?	✓			
Was adequate sample volume provided[1]?	✓			
Are short holding time analytes or samples with HTs due within 48 hours present[1]?		✓		
Is a chain-of-custody (COC) present and filled out completely[1]?	✓			
Does the COC agree with the number and type of sample bottles received[1]?	✓			
Do the sample IDs on the bottle labels match the COC[1]?	✓			
Is the COC properly relinquished by the client with date and time recorded[1]?	✓			
For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.**		✓		
Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / (pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)*	✓			HCL, HNO3
Additional Comments (if any):				

[1]*If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) 6/21/16 Date/Time Reviewed

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW01
6/16/2016 2:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606221-01 (Water)									
Dissolved Metals by 6010C									
Arsenic	ND	0.005	0.030	mg/L	1	1575996	06/22/2016	06/22/2016	U
Barium	**0.0213**	**0.001**	0.005	"	"	"	"	"	
Cadmium	ND	0.001	0.005	"	"	"	"	"	U
Chromium	ND	0.001	0.005	"	"	"	"	"	U
Lead	ND	0.0033	0.010	"	"	"	"	"	U
Selenium	**0.0645**	**0.006**	0.030	"	"	"	"	"	
Silver	ND	0.001	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A									
Mercury	ND	0.000067	0.0002	mg/L	1	1576341	"	06/23/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		5.00	mg/L	1	B6F2207	06/22/2016	06/23/2016	Ua
Diesel (C10-C28)	ND		5.00	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*80.6 %*		*54-117*			"	"	"	
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW01
6/16/2016 2:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-01 (Water)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.00	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW01
6/16/2016 2:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-01 (Water)

VOC by EPA 8260C

2-Butanone	ND	5.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
2-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
2-Hexanone	ND	5.00	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.00	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.00	"	"	"	"	"	Ua
Acetone	ND	8.00	"	"	"	"	"	Ua
Benzene	ND	1.00	"	"	"	"	"	Ua
Bromobenzene	ND	1.00	"	"	"	"	"	Ua
Bromochloromethane	ND	1.00	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.00	"	"	"	"	"	Ua
Bromoform	ND	1.00	"	"	"	"	"	Ua
Bromomethane	ND	1.00	"	"	"	"	"	Ua
Carbon disulfide	ND	5.00	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.00	"	"	"	"	"	Ua
Chlorobenzene	ND	1.00	"	"	"	"	"	Ua
Chloroethane	ND	1.00	"	"	"	"	"	Ua
Chloroform	ND	1.00	"	"	"	"	"	Ua
Chloromethane	ND	1.00	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW01
6/16/2016 2:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-01 (Water)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Dibromochloromethane	ND	1.00	"	"	"	"	"	Ua
Dibromomethane	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.00	"	"	"	"	"	Ua
Iodomethane	ND	10.0	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.00	"	"	"	"	"	Ua
m,p-Xylene	ND	2.00	"	"	"	"	"	Ua
Methylene Chloride	ND	5.00	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.00	"	"	"	"	"	Ua
Naphthalene	ND	4.00	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.00	"	"	"	"	"	Ua
o-Xylene	ND	1.00	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Styrene	ND	1.00	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.00	"	"	"	"	"	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW01
6/16/2016 2:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606221-01 (Water)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Trichloroethene	ND		1.00	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		1.00	"	"	"	"	"	Ua
Vinyl chloride	ND		1.00	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*101 %*		*84-121*			"	"	"	
Surrogate: Toluene-d8	*99.3 %*		*85-115*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*107 %*		*84-114*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW02
6/16/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606221-02 (Water)									
Dissolved Metals by 6010C									
Arsenic	ND	0.005	0.030	mg/L	1	1575996	06/22/2016	06/22/2016	U
Barium	**0.0414**	**0.001**	0.005	"	"	"	"	"	
Cadmium	ND	0.001	0.005	"	"	"	"	"	U
Chromium	**0.00206**	**0.001**	0.005	"	"	"	"	"	J
Lead	ND	0.0033	0.010	"	"	"	"	"	U
Selenium	**0.0559**	**0.006**	0.030	"	"	"	"	"	
Silver	ND	0.001	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A									
Mercury	ND	0.000067	0.0002	mg/L	1	1576341	"	06/23/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		5.00	mg/L	1	B6F2207	06/22/2016	06/23/2016	Ua
Diesel (C10-C28)	ND		5.00	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*67.1 %*		*54-117*			"	"	"	
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW02
6/16/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-02 (Water)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.00	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW02
6/16/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-02 (Water)

VOC by EPA 8260C

2-Butanone	ND	5.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
2-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
2-Hexanone	ND	5.00	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.00	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.00	"	"	"	"	"	Ua
Acetone	**18.6**	8.00	"	"	"	"	"	
Benzene	ND	1.00	"	"	"	"	"	Ua
Bromobenzene	ND	1.00	"	"	"	"	"	Ua
Bromochloromethane	ND	1.00	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.00	"	"	"	"	"	Ua
Bromoform	ND	1.00	"	"	"	"	"	Ua
Bromomethane	ND	1.00	"	"	"	"	"	Ua
Carbon disulfide	ND	5.00	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.00	"	"	"	"	"	Ua
Chlorobenzene	ND	1.00	"	"	"	"	"	Ua
Chloroethane	ND	1.00	"	"	"	"	"	Ua
Chloroform	ND	1.00	"	"	"	"	"	Ua
Chloromethane	ND	1.00	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW02
6/16/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-02 (Water)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Dibromochloromethane	ND	1.00	"	"	"	"	"	Ua
Dibromomethane	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.00	"	"	"	"	"	Ua
Iodomethane	ND	10.0	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.00	"	"	"	"	"	Ua
m,p-Xylene	ND	2.00	"	"	"	"	"	Ua
Methylene Chloride	ND	5.00	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.00	"	"	"	"	"	Ua
Naphthalene	ND	4.00	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.00	"	"	"	"	"	Ua
o-Xylene	ND	1.00	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Styrene	ND	1.00	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.00	"	"	"	"	"	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW02
6/16/2016 11:00:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606221-02 (Water)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Trichloroethene	ND		1.00	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		1.00	"	"	"	"	"	Ua
Vinyl chloride	ND		1.00	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*103 %*		*84-121*			"	"	"	
Surrogate: Toluene-d8	*98.8 %*		*85-115*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*109 %*		*84-114*			"	"	"	

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW03
6/16/2016 11:30:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-03 (Water)

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND	5.00	mg/L	1	B6F2207	06/22/2016	06/23/2016	Ua
Diesel (C10-C28)	ND	5.00	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*77.6 %*	*54-117*			"	"	"	

VOC by EPA 8260C

1,1,1,2-Tetrachloroethane	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW03
6/16/2016 11:30:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-03 (Water)

VOC by EPA 8260C

1,2-Dichlorobenzene	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
2-Butanone	ND	5.00	"	"	"	"	"	Ua
2-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
2-Hexanone	ND	5.00	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.00	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.00	"	"	"	"	"	Ua
Acetone	**12.8**	8.00	"	"	"	"	"	
Benzene	ND	1.00	"	"	"	"	"	Ua
Bromobenzene	ND	1.00	"	"	"	"	"	Ua
Bromochloromethane	ND	1.00	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.00	"	"	"	"	"	Ua
Bromoform	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW03
6/16/2016 11:30:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-03 (Water)

VOC by EPA 8260C

Bromomethane	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Carbon disulfide	ND	5.00	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.00	"	"	"	"	"	Ua
Chlorobenzene	ND	1.00	"	"	"	"	"	Ua
Chloroethane	ND	1.00	"	"	"	"	"	Ua
Chloroform	ND	1.00	"	"	"	"	"	Ua
Chloromethane	ND	1.00	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua
cis-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	Ua
Dibromochloromethane	ND	1.00	"	"	"	"	"	Ua
Dibromomethane	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.00	"	"	"	"	"	Ua
Iodomethane	ND	10.0	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.00	"	"	"	"	"	Ua
m,p-Xylene	ND	2.00	"	"	"	"	"	Ua
Methylene Chloride	ND	5.00	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.00	"	"	"	"	"	Ua
Naphthalene	ND	4.00	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW03
6/16/2016 11:30:00AM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-03 (Water)

VOC by EPA 8260C

n-Propylbenzene	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
o-Xylene	ND	1.00	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Styrene	ND	1.00	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.00	"	"	"	"	"	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua
trans-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	Ua
Trichloroethene	ND	1.00	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.00	"	"	"	"	"	Ua
Vinyl chloride	ND	1.00	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*97.2 %*	*84-121*	"	"	"
Surrogate: Toluene-d8	*99.5 %*	*85-115*	"	"	"
Surrogate: 4-Bromofluorobenzene	*108 %*	*84-114*	"	"	"

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW04
6/16/2016 1:30:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606221-04 (Water)									
Dissolved Metals by 6010C									
Arsenic	ND	0.005	0.030	mg/L	1	1575996	06/22/2016	06/22/2016	U
Barium	**0.034**	**0.001**	0.005	"	"	"	"	"	
Cadmium	ND	0.001	0.005	"	"	"	"	"	U
Chromium	ND	0.001	0.005	"	"	"	"	"	U
Lead	**0.00396**	**0.0033**	0.010	"	"	"	"	"	J
Selenium	**0.0501**	**0.006**	0.030	"	"	"	"	"	
Silver	ND	0.001	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A									
Mercury	ND	0.000067	0.0002	mg/L	1	1576341	"	06/23/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		5.00	mg/L	1	B6F2207	06/22/2016	06/23/2016	Ua
Diesel (C10-C28)	ND		5.00	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*75.8 %*		*54-117*			"	"	"	
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW04
6/16/2016 1:30:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-04 (Water)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.00	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW04
6/16/2016 1:30:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-04 (Water)

VOC by EPA 8260C

2-Butanone	ND	5.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
2-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
2-Hexanone	ND	5.00	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.00	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.00	"	"	"	"	"	Ua
Acetone	ND	8.00	"	"	"	"	"	Ua
Benzene	ND	1.00	"	"	"	"	"	Ua
Bromobenzene	ND	1.00	"	"	"	"	"	Ua
Bromochloromethane	ND	1.00	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.00	"	"	"	"	"	Ua
Bromoform	ND	1.00	"	"	"	"	"	Ua
Bromomethane	ND	1.00	"	"	"	"	"	Ua
Carbon disulfide	ND	5.00	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.00	"	"	"	"	"	Ua
Chlorobenzene	ND	1.00	"	"	"	"	"	Ua
Chloroethane	ND	1.00	"	"	"	"	"	Ua
Chloroform	ND	1.00	"	"	"	"	"	Ua
Chloromethane	ND	1.00	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW04
6/16/2016 1:30:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-04 (Water)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Dibromochloromethane	ND	1.00	"	"	"	"	"	Ua
Dibromomethane	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.00	"	"	"	"	"	Ua
Iodomethane	ND	10.0	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.00	"	"	"	"	"	Ua
m,p-Xylene	ND	2.00	"	"	"	"	"	Ua
Methylene Chloride	ND	5.00	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.00	"	"	"	"	"	Ua
Naphthalene	ND	4.00	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.00	"	"	"	"	"	Ua
o-Xylene	ND	1.00	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Styrene	ND	1.00	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.00	"	"	"	"	"	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW04
6/16/2016 1:30:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-04 (Water)

VOC by EPA 8260C

trans-1,3-Dichloropropene	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Trichloroethene	ND	1.00	"	"	"	"	"	Ua
Trichlorofluoromethane	ND	1.00	"	"	"	"	"	Ua
Vinyl chloride	ND	1.00	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	*99.8 %*	*84-121*	"	"	"
Surrogate: Toluene-d8	*99.9 %*	*85-115*	"	"	"
Surrogate: 4-Bromofluorobenzene	*104 %*	*84-114*	"	"	"

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW05
6/16/2016 12:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
X606221-05 (Water)									
Dissolved Metals by 6010C									
Arsenic	ND	0.005	0.030	mg/L	1	1575996	06/22/2016	06/22/2016	U
Barium	**0.0162**	**0.001**	0.005	"	"	"	"	"	
Cadmium	ND	0.001	0.005	"	"	"	"	"	U
Chromium	ND	0.001	0.005	"	"	"	"	"	U
Lead	ND	0.0033	0.010	"	"	"	"	"	U
Selenium	**0.0144**	**0.006**	0.030	"	"	"	"	"	J
Silver	ND	0.001	0.005	"	"	"	"	"	U
Dissolved Metals by 7470A									
Mercury	ND	0.000067	0.0002	mg/L	1	1576341	"	06/23/2016	U
GRO (TVPH)/DRO (TEPH)by EPA 8015C									
Gasoline (C6-C10)	ND		5.00	mg/L	1	B6F2207	06/22/2016	06/23/2016	Ua
Diesel (C10-C28)	ND		5.00	"	"	"	"	"	Ua
Surrogate: o-Terphenyl	*63.9 %*		*54-117*			"	"	"	
VOC by EPA 8260C									
1,1,1,2-Tetrachloroethane	ND		1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW05
6/16/2016 12:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-05 (Water)

VOC by EPA 8260C

1,1,1-Trichloroethane	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	Ua
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	Ua
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	Ua
1,2,3-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,3-Trichloropropane	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	Ua
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	Ua
1,2-Dibromoethane (EDB)	ND	1.00	"	"	"	"	"	Ua
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	Ua
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	Ua
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	Ua
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW05
6/16/2016 12:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-05 (Water)

VOC by EPA 8260C

2-Butanone	ND	5.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
2-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
2-Hexanone	ND	5.00	"	"	"	"	"	Ua
4-Chlorotoluene	ND	1.00	"	"	"	"	"	Ua
4-Isopropyltoluene	ND	1.00	"	"	"	"	"	Ua
4-Methyl-2-pentanone	ND	5.00	"	"	"	"	"	Ua
Acetone	ND	8.00	"	"	"	"	"	Ua
Benzene	ND	1.00	"	"	"	"	"	Ua
Bromobenzene	ND	1.00	"	"	"	"	"	Ua
Bromochloromethane	ND	1.00	"	"	"	"	"	Ua
Bromodichloromethane	ND	1.00	"	"	"	"	"	Ua
Bromoform	ND	1.00	"	"	"	"	"	Ua
Bromomethane	ND	1.00	"	"	"	"	"	Ua
Carbon disulfide	ND	5.00	"	"	"	"	"	Ua
Carbon tetrachloride	ND	1.00	"	"	"	"	"	Ua
Chlorobenzene	ND	1.00	"	"	"	"	"	Ua
Chloroethane	ND	1.00	"	"	"	"	"	Ua
Chloroform	ND	1.00	"	"	"	"	"	Ua
Chloromethane	ND	1.00	"	"	"	"	"	Ua
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW05
6/16/2016 12:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes

Origins Laboratory, Inc.

X606221-05 (Water)

VOC by EPA 8260C

cis-1,3-Dichloropropene	ND	1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Dibromochloromethane	ND	1.00	"	"	"	"	"	Ua
Dibromomethane	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Hexachlorobutadiene	ND	5.00	"	"	"	"	"	Ua
Iodomethane	ND	10.0	"	"	"	"	"	Ua
Isopropylbenzene	ND	1.00	"	"	"	"	"	Ua
m,p-Xylene	ND	2.00	"	"	"	"	"	Ua
Methylene Chloride	ND	5.00	"	"	"	"	"	Ua
Methyl tert-Butyl Ether	ND	1.00	"	"	"	"	"	Ua
Naphthalene	ND	4.00	"	"	"	"	"	Ua
n-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
n-Propylbenzene	ND	1.00	"	"	"	"	"	Ua
o-Xylene	ND	1.00	"	"	"	"	"	Ua
sec-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Styrene	ND	1.00	"	"	"	"	"	Ua
tert-Butylbenzene	ND	1.00	"	"	"	"	"	Ua
Tetrachloroethene	ND	1.00	"	"	"	"	"	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

RW2GW05
6/16/2016 12:00:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
Origins Laboratory, Inc.									
X606221-05 (Water)									
VOC by EPA 8260C									
trans-1,3-Dichloropropene	ND		1.00	ug/L	1	B6F2004	06/20/2016	06/20/2016	Ua
Trichloroethene	ND		1.00	"	"	"	"	"	Ua
Trichlorofluoromethane	ND		1.00	"	"	"	"	"	Ua
Vinyl chloride	ND		1.00	"	"	"	"	"	Ua
Surrogate: 1,2-Dichloroethane-d4	*99.9 %*		*84-121*			"	"	"	
Surrogate: Toluene-d8	*100 %*		*85-115*			"	"	"	
Surrogate: 4-Bromofluorobenzene	*107 %*		*84-114*			"	"	"	

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Blank (B6F2004-BLK1)					Prepared: 06/20/2016 Analyzed: 06/20/2016					
1,1,1,2-Tetrachloroethane	ND	1.00	ug/L							Ua
1,1,1-Trichloroethane	ND	1.00	"							Ua
1,1,2,2-Tetrachloroethane	ND	1.00	"							Ua
1,1,2-Trichloroethane	ND	1.00	"							Ua
1,1-Dichloroethane	ND	1.00	"							Ua
1,1-Dichloroethene	ND	1.00	"							Ua
1,1-Dichloropropene	ND	1.00	"							Ua
1,2,3-Trichlorobenzene	ND	5.00	"							Ua
1,2,3-Trichloropropane	ND	5.00	"							Ua
1,2,4-Trichlorobenzene	ND	5.00	"							Ua
1,2,4-Trimethylbenzene	ND	1.00	"							Ua
1,2-Dibromo-3-chloropropane	ND	5.00	"							Ua
1,2-Dibromoethane (EDB)	ND	1.00	"							Ua
1,2-Dichlorobenzene	ND	1.00	"							Ua
1,2-Dichloroethane	ND	1.00	"							Ua
1,2-Dichloropropane	ND	1.00	"							Ua
1,3,5-Trimethylbenzene	ND	1.00	"							Ua
1,3-Dichlorobenzene	ND	1.00	"							Ua
1,3-Dichloropropane	ND	1.00	"							Ua
1,4-Dichlorobenzene	ND	1.00	"							Ua
2,2-Dichloropropane	ND	1.00	"							Ua
2-Butanone	ND	5.00	"							Ua
2-Chlorotoluene	ND	1.00	"							Ua
2-Hexanone	ND	5.00	"							Ua
4-Chlorotoluene	ND	1.00	"							Ua
4-Isopropyltoluene	ND	1.00	"							Ua

Origins Laboratory, Inc.

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Blank (B6F2004-BLK1)				Prepared: 06/20/2016 Analyzed: 06/20/2016						
4-Methyl-2-pentanone	ND	5.00	ug/L							Ua
Acetone	ND	8.00	"							Ua
Benzene	ND	1.00	"							Ua
Bromobenzene	ND	1.00	"							Ua
Bromochloromethane	ND	1.00	"							Ua
Bromodichloromethane	ND	1.00	"							Ua
Bromoform	ND	1.00	"							Ua
Bromomethane	ND	1.00	"							Ua
Carbon disulfide	ND	5.00	"							Ua
Carbon tetrachloride	ND	1.00	"							Ua
Chlorobenzene	ND	1.00	"							Ua
Chloroethane	ND	1.00	"							Ua
Chloroform	ND	1.00	"							Ua
Chloromethane	ND	1.00	"							Ua
cis-1,2-Dichloroethene	ND	1.00	"							Ua
cis-1,3-Dichloropropene	ND	1.00	"							Ua
Dibromochloromethane	ND	1.00	"							Ua
Dibromomethane	ND	1.00	"							Ua
Ethylbenzene	ND	1.00	"							Ua
Hexachlorobutadiene	ND	5.00	"							Ua
Iodomethane	ND	10.0	"							Ua
Isopropylbenzene	ND	1.00	"							Ua
m,p-Xylene	ND	2.00	"							Ua
Methylene Chloride	ND	5.00	"							Ua
Methyl tert-Butyl Ether	ND	1.00	"							Ua
Naphthalene	ND	4.00	"							Ua

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Project Number: 11600702
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Blank (B6F2004-BLK1)					Prepared: 06/20/2016 Analyzed: 06/20/2016					
n-Butylbenzene	ND	1.00	ug/L							Ua
n-Propylbenzene	ND	1.00	"							Ua
o-Xylene	ND	1.00	"							Ua
sec-Butylbenzene	ND	1.00	"							Ua
Styrene	ND	1.00	"							Ua
tert-Butylbenzene	ND	1.00	"							Ua
Tetrachloroethene	ND	1.00	"							Ua
Toluene	ND	1.00	"							Ua
trans-1,2-Dichloroethene	ND	1.00	"							Ua
trans-1,3-Dichloropropene	ND	1.00	"							Ua
Trichloroethene	ND	1.00	"							Ua
Trichlorofluoromethane	ND	1.00	"							Ua
Vinyl chloride	ND	1.00	"							Ua
Surrogate: 1,2-Dichloroethane-d4	*60*		"	*62.5*		*96.4*	*84-121*			
Surrogate: Toluene-d8	*62*		"	*62.5*		*98.5*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*68*		"	*62.5*		*108*	*84-114*			

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
LCS (B6F2004-BS1)					Prepared: 06/20/2016 Analyzed: 06/20/2016					
1,1,1,2-Tetrachloroethane	56.8	1.00	ug/L	50.0		114	78.8-128			
1,1,1-Trichloroethane	53.6	1.00	"	50.0		107	82.3-118			
1,1,2,2-Tetrachloroethane	58.2	1.00	"	50.0		116	67.9-119			
1,1,2-Trichloroethane	56.0	1.00	"	50.0		112	75.4-116			
1,1-Dichloroethane	58.1	1.00	"	50.0		116	80-120			
1,1-Dichloroethene	56.8	1.00	"	50.0		114	79.4-118			
1,1-Dichloropropene	58.1	1.00	"	50.0		116	78-120			
1,2,3-Trichlorobenzene	55.1	5.00	"	50.0		110	63.8-134			
1,2,3-Trichloropropane	60.0	5.00	"	50.0		120	63.3-121			
1,2,4-Trichlorobenzene	55.0	5.00	"	50.0		110	70.4-125			
1,2,4-Trimethylbenzene	58.0	1.00	"	50.0		116	73.3-123			
1,2-Dibromo-3-chloropropane	58.9	5.00	"	50.0		118	80-120			
1,2-Dibromoethane (EDB)	57.3	1.00	"	50.0		115	74.7-127			
1,2-Dichlorobenzene	54.0	1.00	"	50.0		108	81.3-116			
1,2-Dichloroethane	57.4	1.00	"	50.0		115	71.1-120			
1,2-Dichloropropane	57.9	1.00	"	50.0		116	80-120			
1,3,5-Trimethylbenzene	58.3	1.00	"	50.0		117	71.9-128			
1,3-Dichlorobenzene	55.0	1.00	"	50.0		110	82.1-117			
1,3-Dichloropropane	58.2	1.00	"	50.0		116	75.1-123			
1,4-Dichlorobenzene	54.5	1.00	"	50.0		109	76.8-119			
2,2-Dichloropropane	52.0	1.00	"	50.0		104	84-120			
2-Butanone	278	5.00	"	250		111	64.9-123			
2-Chlorotoluene	57.2	1.00	"	50.0		114	66-133			
2-Hexanone	282	5.00	"	250		113	80-120			
4-Chlorotoluene	56.8	1.00	"	50.0		114	73.2-119			
4-Isopropyltoluene	59.9	1.00	"	50.0		120	79.8-120			

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
LCS (B6F2004-BS1)					Prepared: 06/20/2016 Analyzed: 06/20/2016					
4-Methyl-2-pentanone	282	5.00	ug/L	250		113	58.5-122			
Acetone	295	8.00	"	250		118	65.4-125			
Benzene	58.1	1.00	"	50.0		116	75.5-116			
Bromobenzene	60.1	1.00	"	50.0		120	70-130			
Bromochloromethane	54.7	1.00	"	50.0		109	79-115			
Bromodichloromethane	59.6	1.00	"	50.0		119	73-123			
Bromoform	59.3	1.00	"	50.0		119	75-128			
Bromomethane	56.4	1.00	"	50.0		113	72-138			
Carbon disulfide	54.8	5.00	"	50.0		110	69-129			
Carbon tetrachloride	57.3	1.00	"	50.0		115	80-124			
Chlorobenzene	55.9	1.00	"	50.0		112	78-121			
Chloroethane	55.4	1.00	"	50.0		111	77-138			
Chloroform	57.5	1.00	"	50.0		115	75-117			
Chloromethane	52.9	1.00	"	50.0		106	72-130			
cis-1,2-Dichloroethene	58.3	1.00	"	50.0		117	78-118			
cis-1,3-Dichloropropene	58.0	1.00	"	50.0		116	73-122			
Dibromochloromethane	57.4	1.00	"	50.0		115	78-119			
Dibromomethane	57.8	1.00	"	50.0		116	79-116			
Ethylbenzene	58.6	1.00	"	50.0		117	78-130			
Hexachlorobutadiene	55.5	5.00	"	50.0		111	72-129			
Iodomethane	49.6	10.0	"	50.0		99.1	74-121			
Isopropylbenzene	58.9	1.00	"	50.0		118	75-128			
m,p-Xylene	120	2.00	"	100		120	75-134			
Methylene Chloride	50.7	5.00	"	50.0		101	80-122			
Methyl tert-Butyl Ether	60.3	1.00	"	50.0		121	72-125			
Naphthalene	56.0	4.00	"	50.0		112	65-128			

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Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
LCS (B6F2004-BS1)					Prepared: 06/20/2016 Analyzed: 06/20/2016					
n-Butylbenzene	57.4	1.00	ug/L	50.0		115	69-134			
n-Propylbenzene	59.5	1.00	"	50.0		119	74-132			
o-Xylene	58.3	1.00	"	50.0		117	76-129			
sec-Butylbenzene	59.2	1.00	"	50.0		118	74-128			
Styrene	58.5	1.00	"	50.0		117	74-126			
tert-Butylbenzene	58.8	1.00	"	50.0		118	72-123			
Tetrachloroethene	54.3	1.00	"	50.0		109	78-132			
Toluene	55.3	1.00	"	50.0		111	76-128			
trans-1,2-Dichloroethene	57.8	1.00	"	50.0		116	79-120			
trans-1,3-Dichloropropene	58.0	1.00	"	50.0		116	74-122			
Trichloroethene	59.2	1.00	"	50.0		118	76-125			
Trichlorofluoromethane	55.3	1.00	"	50.0		111	66-149			
Vinyl chloride	51.8	1.00	"	50.0		104	70-137			
Surrogate: 1,2-Dichloroethane-d4	*61*		"	*62.5*		*97.5*	*84-121*			
Surrogate: Toluene-d8	*60*		"	*62.5*		*96.1*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*66*		"	*62.5*		*105*	*84-114*			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Matrix Spike (B6F2004-MS1)		**Source: X606235-03**			Prepared: 06/20/2016 Analyzed: 06/20/2016					
1,1,1,2-Tetrachloroethane	55.2	1.00	ug/L	50.0	ND	110	82-130			
1,1,1-Trichloroethane	50.2	1.00	"	50.0	ND	100	81-125			
1,1,2,2-Tetrachloroethane	52.7	1.00	"	50.0	ND	105	74-120			
1,1,2-Trichloroethane	55.5	1.00	"	50.0	ND	111	80-118			
1,1-Dichloroethane	54.1	1.00	"	50.0	ND	108	79-120			
1,1-Dichloroethene	52.5	1.00	"	50.0	ND	105	73-130			
1,1-Dichloropropene	53.4	1.00	"	50.0	ND	107	77-124			
1,2,3-Trichlorobenzene	51.9	5.00	"	50.0	ND	104	55-144			
1,2,3-Trichloropropane	55.3	5.00	"	50.0	ND	111	67-126			
1,2,4-Trichlorobenzene	53.2	5.00	"	50.0	ND	106	56-141			
1,2,4-Trimethylbenzene	57.2	1.00	"	50.0	ND	114	62-132			
1,2-Dibromo-3-chloropropane	51.8	5.00	"	50.0	ND	104	56-142			
1,2-Dibromoethane (EDB)	54.6	1.00	"	50.0	ND	109	84-124			
1,2-Dichlorobenzene	52.5	1.00	"	50.0	ND	105	74-124			
1,2-Dichloroethane	52.5	1.00	"	50.0	ND	105	76-120			
1,2-Dichloropropane	54.0	1.00	"	50.0	ND	108	78-117			
1,3,5-Trimethylbenzene	57.8	1.00	"	50.0	ND	116	64-138			
1,3-Dichlorobenzene	54.3	1.00	"	50.0	ND	109	73-126			
1,3-Dichloropropane	54.7	1.00	"	50.0	ND	109	83-120			
1,4-Dichlorobenzene	53.9	1.00	"	50.0	ND	108	64-130			
2,2-Dichloropropane	50.7	1.00	"	50.0	ND	101	77-129			
2-Butanone	239	5.00	"	250	ND	95.7	66-128			
2-Chlorotoluene	56.1	1.00	"	50.0	ND	112	71-130			
2-Hexanone	244	5.00	"	250	ND	97.5	74-123			
4-Chlorotoluene	55.4	1.00	"	50.0	ND	111	66-128			
4-Isopropyltoluene	58.9	1.00	"	50.0	ND	118	60-140			

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Corinne Wardell
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Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Matrix Spike (B6F2004-MS1)		**Source: X606235-03**			Prepared: 06/20/2016 Analyzed: 06/20/2016					
4-Methyl-2-pentanone	263	5.00	ug/L	250	ND	105	65-125			
Acetone	259	8.00	"	250	ND	104	63-134			
Benzene	54.5	1.00	"	50.0	ND	109	74-130			
Bromobenzene	58.6	1.00	"	50.0	ND	117	70-130			
Bromochloromethane	51.2	1.00	"	50.0	ND	102	80-118			
Bromodichloromethane	55.4	1.00	"	50.0	ND	111	76-122			
Bromoform	54.5	1.00	"	50.0	ND	109	80-128			
Bromomethane	57.6	1.00	"	50.0	ND	115	69-144			
Carbon disulfide	51.0	5.00	"	50.0	ND	102	70-131			
Carbon tetrachloride	52.9	1.00	"	50.0	ND	106	81-130			
Chlorobenzene	54.6	1.00	"	50.0	ND	109	72-128			
Chloroethane	56.9	1.00	"	50.0	ND	114	79-140			
Chloroform	53.9	1.00	"	50.0	ND	108	76-118			
Chloromethane	53.7	1.00	"	50.0	ND	107	72-128			
cis-1,2-Dichloroethene	54.5	1.00	"	50.0	ND	109	78-120			
cis-1,3-Dichloropropene	56.4	1.00	"	50.0	ND	113	79-120			
Dibromochloromethane	53.8	1.00	"	50.0	ND	108	81-121			
Dibromomethane	52.7	1.00	"	50.0	ND	105	84-115			
Ethylbenzene	56.8	1.00	"	50.0	ND	114	76-132			
Hexachlorobutadiene	54.3	5.00	"	50.0	ND	109	70-130			
Iodomethane	47.1	10.0	"	50.0	ND	94.2	72-127			
Isopropylbenzene	57.4	1.00	"	50.0	ND	115	66-135			
m,p-Xylene	117	2.00	"	100	ND	117	69-139			
Methylene Chloride	44.5	5.00	"	50.0	ND	89.0	87-118			
Methyl tert-Butyl Ether	53.3	1.00	"	50.0	ND	107	62-138			
Naphthalene	51.0	4.00	"	50.0	ND	102	59-148			

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Corinne Wardell
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Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Matrix Spike (B6F2004-MS1)		**Source: X606235-03**			Prepared: 06/20/2016 Analyzed: 06/20/2016					
n-Butylbenzene	56.7	1.00	ug/L	50.0	ND	113	52-146			
n-Propylbenzene	58.0	1.00	"	50.0	ND	116	66-141			
o-Xylene	56.3	1.00	"	50.0	ND	113	74-131			
sec-Butylbenzene	58.5	1.00	"	50.0	ND	117	63-138			
Styrene	57.7	1.00	"	50.0	ND	115	72-128			
tert-Butylbenzene	57.8	1.00	"	50.0	ND	116	67-129			
Tetrachloroethene	53.3	1.00	"	50.0	ND	107	76-134			
Toluene	53.9	1.00	"	50.0	ND	108	73-131			
trans-1,2-Dichloroethene	54.1	1.00	"	50.0	ND	108	78-123			
trans-1,3-Dichloropropene	56.4	1.00	"	50.0	ND	113	75-125			
Trichloroethene	55.6	1.00	"	50.0	ND	111	73-131			
Trichlorofluoromethane	55.9	1.00	"	50.0	ND	112	83-141			
Vinyl chloride	52.4	1.00	"	50.0	ND	105	73-139			
Surrogate: 1,2-Dichloroethane-d4	*58*		"	*62.5*		*92.2*	*84-121*			
Surrogate: Toluene-d8	*63*		"	*62.5*		*100*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*66*		"	*62.5*		*106*	*84-114*			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Matrix Spike Dup (B6F2004-MSD1)		**Source: X606235-03**			Prepared: 06/20/2016 Analyzed: 06/20/2016					
1,1,1,2-Tetrachloroethane	54.5	1.00	ug/L	50.0	ND	109	82-130	1.29	20	
1,1,1-Trichloroethane	51.3	1.00	"	50.0	ND	103	81-125	2.25	20	
1,1,2,2-Tetrachloroethane	54.8	1.00	"	50.0	ND	110	74-120	3.85	20	
1,1,2-Trichloroethane	53.1	1.00	"	50.0	ND	106	80-118	4.42	20	
1,1-Dichloroethane	54.7	1.00	"	50.0	ND	109	79-120	1.10	20	
1,1-Dichloroethene	53.2	1.00	"	50.0	ND	106	73-130	1.27	20	
1,1-Dichloropropene	54.6	1.00	"	50.0	ND	109	77-124	2.22	20	
1,2,3-Trichlorobenzene	51.4	5.00	"	50.0	ND	103	55-144	0.871	20	
1,2,3-Trichloropropane	56.0	5.00	"	50.0	ND	112	67-126	1.15	20	
1,2,4-Trichlorobenzene	51.8	5.00	"	50.0	ND	104	56-141	2.61	20	
1,2,4-Trimethylbenzene	55.2	1.00	"	50.0	ND	110	62-132	3.60	20	
1,2-Dibromo-3-chloropropane	55.4	5.00	"	50.0	ND	111	56-142	6.79	20	
1,2-Dibromoethane (EDB)	55.0	1.00	"	50.0	ND	110	84-124	0.876	20	
1,2-Dichlorobenzene	51.0	1.00	"	50.0	ND	102	74-124	2.92	20	
1,2-Dichloroethane	53.4	1.00	"	50.0	ND	107	76-120	1.83	20	
1,2-Dichloropropane	54.7	1.00	"	50.0	ND	109	78-117	1.40	20	
1,3,5-Trimethylbenzene	55.6	1.00	"	50.0	ND	111	64-138	3.99	20	
1,3-Dichlorobenzene	51.3	1.00	"	50.0	ND	103	73-126	5.70	20	
1,3-Dichloropropane	55.4	1.00	"	50.0	ND	111	83-120	1.40	20	
1,4-Dichlorobenzene	51.6	1.00	"	50.0	ND	103	64-130	4.34	20	
2,2-Dichloropropane	51.7	1.00	"	50.0	ND	103	77-129	1.95	20	
2-Butanone	258	5.00	"	250	ND	103	66-128	7.58	20	
2-Chlorotoluene	54.1	1.00	"	50.0	ND	108	71-130	3.68	20	
2-Hexanone	260	5.00	"	250	ND	104	74-123	6.43	20	
4-Chlorotoluene	53.2	1.00	"	50.0	ND	106	66-128	4.12	20	
4-Isopropyltoluene	56.3	1.00	"	50.0	ND	113	60-140	4.46	20	

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Corinne Wardell
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Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Matrix Spike Dup (B6F2004-MSD1)		**Source: X606235-03**			Prepared: 06/20/2016 Analyzed: 06/20/2016					
4-Methyl-2-pentanone	281	5.00	ug/L	250	ND	112	65-125	6.28	20	
Acetone	270	8.00	"	250	ND	108	63-134	4.00	20	
Benzene	54.9	1.00	"	50.0	ND	110	74-130	0.786	20	
Bromobenzene	56.7	1.00	"	50.0	ND	113	70-130	3.28	20	
Bromochloromethane	51.8	1.00	"	50.0	ND	104	80-118	1.24	20	
Bromodichloromethane	56.5	1.00	"	50.0	ND	113	76-122	1.89	20	
Bromoform	55.3	1.00	"	50.0	ND	111	80-128	1.35	20	
Bromomethane	56.5	1.00	"	50.0	ND	113	69-144	2.09	20	
Carbon disulfide	51.6	5.00	"	50.0	ND	103	70-131	1.03	20	
Carbon tetrachloride	54.7	1.00	"	50.0	ND	109	81-130	3.40	20	
Chlorobenzene	53.6	1.00	"	50.0	ND	107	72-128	1.85	20	
Chloroethane	54.3	1.00	"	50.0	ND	109	79-140	4.66	20	
Chloroform	54.8	1.00	"	50.0	ND	110	76-118	1.62	20	
Chloromethane	51.4	1.00	"	50.0	ND	103	72-128	4.49	20	
cis-1,2-Dichloroethene	55.4	1.00	"	50.0	ND	111	78-120	1.67	20	
cis-1,3-Dichloropropene	56.4	1.00	"	50.0	ND	113	79-120	0.00	20	
Dibromochloromethane	55.0	1.00	"	50.0	ND	110	81-121	2.06	20	
Dibromomethane	54.5	1.00	"	50.0	ND	109	84-115	3.43	20	
Ethylbenzene	55.3	1.00	"	50.0	ND	111	76-132	2.80	20	
Hexachlorobutadiene	53.2	5.00	"	50.0	ND	106	70-130	2.20	20	
Iodomethane	47.1	10.0	"	50.0	ND	94.2	72-127	0.0637	20	
Isopropylbenzene	55.8	1.00	"	50.0	ND	112	66-135	2.84	20	
m,p-Xylene	113	2.00	"	100	ND	113	69-139	3.69	20	
Methylene Chloride	43.8	5.00	"	50.0	ND	87.7	87-118	1.54	20	
Methyl tert-Butyl Ether	56.7	1.00	"	50.0	ND	113	62-138	6.27	20	
Naphthalene	50.7	4.00	"	50.0	ND	101	59-148	0.511	20	

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Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2004 - EPA 5030B (Water)										
Matrix Spike Dup (B6F2004-MSD1)		**Source: X606235-03**			Prepared: 06/20/2016 Analyzed: 06/20/2016					
n-Butylbenzene	53.8	1.00	ug/L	50.0	ND	108	52-146	5.32	20	
n-Propylbenzene	55.7	1.00	"	50.0	ND	111	66-141	4.04	20	
o-Xylene	55.0	1.00	"	50.0	ND	110	74-131	2.44	20	
sec-Butylbenzene	56.4	1.00	"	50.0	ND	113	63-138	3.59	20	
Styrene	55.1	1.00	"	50.0	ND	110	72-128	4.52	20	
tert-Butylbenzene	56.3	1.00	"	50.0	ND	113	67-129	2.63	20	
Tetrachloroethene	51.8	1.00	"	50.0	ND	104	76-134	2.82	20	
Toluene	52.8	1.00	"	50.0	ND	106	73-131	2.08	20	
trans-1,2-Dichloroethene	54.1	1.00	"	50.0	ND	108	78-123	0.0554	20	
trans-1,3-Dichloropropene	56.4	1.00	"	50.0	ND	113	75-125	0.00	20	
Trichloroethene	56.4	1.00	"	50.0	ND	113	73-131	1.54	20	
Trichlorofluoromethane	53.5	1.00	"	50.0	ND	107	83-141	4.40	20	
Vinyl chloride	50.2	1.00	"	50.0	ND	100	73-139	4.44	20	
Surrogate: 1,2-Dichloroethane-d4	*61*		"	*62.5*		*96.9*	*84-121*			
Surrogate: Toluene-d8	*62*		"	*62.5*		*99.3*	*85-115*			
Surrogate: 4-Bromofluorobenzene	*66*		"	*62.5*		*106*	*84-114*			

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B6F2207 - EPA 3511 Mod.										
Blank (B6F2207-BLK1)					Prepared: 06/22/2016 Analyzed: 06/23/2016					
Gasoline (C6-C10)	ND	5.00	mg/L							Ua
Diesel (C10-C28)	ND	5.00	"							Ua
Surrogate: o-Terphenyl	*3.8*		*"*	*5.00*		*76.7*	*54-117*			
LCS (B6F2207-BS1)					Prepared: 06/22/2016 Analyzed: 06/23/2016					
Gasoline (C6-C10)	86.0	5.00	mg/L	100		86.0	69-125			
Diesel (C10-C28)	97.9	5.00	"	100		97.9	61-120			
Surrogate: o-Terphenyl	*4.4*		*"*	*5.00*		*87.3*	*54-117*			
Matrix Spike (B6F2207-MS1)		**Source: X606221-01**			Prepared: 06/22/2016 Analyzed: 06/23/2016					
Gasoline (C6-C10)	67.7	5.00	mg/L	100	ND	67.7	70-127			QM-07
Diesel (C10-C28)	83.8	5.00	"	100	ND	83.8	54-126			
Surrogate: o-Terphenyl	*3.7*		*"*	*5.00*		*74.8*	*54-117*			
Matrix Spike Dup (B6F2207-MSD1)		**Source: X606221-01**			Prepared: 06/22/2016 Analyzed: 06/23/2016					
Gasoline (C6-C10)	66.5	5.00	mg/L	100	ND	66.5	70-127	1.78	20	QM-07
Diesel (C10-C28)	76.1	5.00	"	100	ND	76.1	54-126	9.53	20	
Surrogate: o-Terphenyl	*3.5*		*"*	*5.00*		*69.8*	*54-117*			

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Project: CCOD Federal

Dissolved Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1575996 - SW846 3005A										
BLANK (1203571189-BLK)					Prepared: 06/22/2016 Analyzed: 06/22/2016					
Cadmium	ND	0.005	mg/L				-			U
Selenium	ND	0.030	"				-			U
Silver	ND	0.005	"				-			U
Chromium	ND	0.005	"				-			U
Arsenic	ND	0.030	"				-			U
Lead	ND	0.010	"				-			U
Barium	ND	0.005	"				-			U
LCS (1203571190-BKS)					Prepared: 06/22/2016 Analyzed: 06/22/2016					
Selenium	0.478	0.030	mg/L	0.500		95.6	80-120			
Lead	0.495	0.010	"	0.500		99	80-120			
Chromium	0.486	0.005	"	0.500		97.1	80-120			
Cadmium	0.488	0.005	"	0.500		97.6	80-120			
Barium	0.491	0.005	"	0.500		98.3	80-120			
Arsenic	0.494	0.030	"	0.500		98.8	80-120			
Silver	0.472	0.005	"	0.500		94.5	80-120			
DUP (1203571191 D)		**Source: X606221-01**			Prepared: 06/22/2016 Analyzed: 06/22/2016					
Lead	ND	0.010	mg/L		<0.0033		0-20	132	20	U
Chromium	ND	0.005	"		<0.001		0-20	110	20	U
Cadmium	ND	0.005	"		<0.001		0-20	60.7	20	U
Barium	0.0213	0.005	"		0.0213		0-20	0.249	20	
Arsenic	ND	0.030	"		<0.005		0-20	28.3	20	U
Silver	ND	0.005	"		<0.001		0-20	0.149	20	U
Selenium	0.0586	0.030	"		0.0645		0-20	9.59	20	
MS (1203571192 S)		**Source: X606221-01**			Prepared: 06/22/2016 Analyzed: 06/22/2016					

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Lakewood CO 80232

Corinne Wardell
Project Number: 11600702
Project: CCOD Federal

Dissolved Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1575996 - SW846 3005A										
MS (1203571192 S)		**Source: X606221-01**			Prepared: 06/22/2016 Analyzed: 06/22/2016					
Chromium	0.475	0.005	mg/L	0.500	<0.001	94.9	75-125			
Lead	0.491	0.010	"	0.500	<0.0033	98.2	75-125			
Cadmium	0.475	0.005	"	0.500	<0.001	95	75-125			
Barium	0.507	0.005	"	0.500	0.0213	97.2	75-125			
Arsenic	0.517	0.030	"	0.500	<0.005	103	75-125			
Silver	0.487	0.005	"	0.500	<0.001	97.5	75-125			
Selenium	0.550	0.030	"	0.500	0.0645	97.1	75-125			

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Notes and Definitions

Ua	Sample is Non-Detect.
U	Result not detected above the detection limit
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Greater than the detection limit but less than the reporting limit
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

All soil results are reported on a wet weight basis.

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Appendix B Environmental Protection Agency Regional Screening Levels- Industrial and Residential, EPA Toxicity Maximum Concentrations of Contaminants, CDPHE-Hazardous Materials and Waste Management Division Groundwater Protection Values Soil Cleanup Table

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (μg/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (μg/m^3)	key	Industrial Air (μg/m^3)	key	Tapwater (μg/L)	key	MCL (μg/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
8.7E-03	I			4.0E-03	I					1	0.1		Acephate	30560-19-1	2.5E+01	n	2.6E+02	c**					8.0E+00	n		1.8E-03	n	
		2.2E-06	I			9.0E-03	I	V		1		1.1E+05	Acetaldehyde	75-07-0	8.2E+00	n	3.4E+01	n	9.4E-01	n	3.9E+00	n	1.9E+00	n		3.8E-04	n	
				2.0E-02	I					1	0.1		Acetochlor	34256-82-1	1.3E+02	n	1.6E+03	n					3.5E+01	n		2.8E-02	n	
				9.0E-01	I	3.1E+01	A	V		1		1.1E+05	Acetone	67-64-1	6.1E+03	n	6.7E+04	n	3.2E+03	n	1.4E+04	n	1.4E+03	n		2.9E-01	n	
						2.0E-03	X			1	0.1		Acetone Cyanohydrin	75-86-5	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n						
						6.0E-02	I	V		1		1.3E+05	Acetonitrile	75-05-8	8.1E+01	n	3.4E+02	n	6.3E+00	n	2.6E+01	n	1.3E+01	n		2.6E-03	n	
				1.0E-01	I			V		1		2.5E+03	Acetophenone	98-86-2	7.8E+02	n	1.2E+04	ns					1.9E+02	n		5.8E-02	n	
3.8E+00	C	1.3E-03	C							1	0.1		Acetylaminofluorene, 2-	53-96-3	1.4E-01	c	6.0E-01	c	2.2E-03	c	9.4E-03	c	1.6E-02	c		7.2E-05	c	
				5.0E-04	I	2.0E-05	I	V		1		2.3E+04	Acrolein	107-02-8	1.4E-02	n	6.0E-02	n	2.1E-03	n	8.8E-03	n	4.2E-03	n		8.4E-07	n	
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I		M	1	0.1		Acrylamide	79-06-1	2.4E-01	c*	4.6E+00	c*	1.0E-02	c*	1.2E-01	c*	5.0E-02	c*		1.1E-05	c*	
				5.0E-01	I	1.0E-03	I	V		1		1.1E+05	Acrylic Acid	79-10-7	9.9E+00	n	4.2E+01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		4.2E-05	n	
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	Acrylonitrile	107-13-1	2.5E-01	c**	1.1E+00	c**	4.1E-02	c**	1.8E-01	c**	5.2E-02	c**		1.1E-05	c**	
						6.0E-03	P			1	0.1		Adiponitrile	111-69-3	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n						
5.6E-02	C			1.0E-02	I					1	0.1		Alachlor	15972-60-8	9.7E+00	c**	4.1E+01	c*					1.1E+00	c*	2.0E+00	8.7E-04	c*	1.6E-03
				1.0E-03	I					1	0.1		Aldicarb	116-06-3	6.3E+00	n	8.2E+01	n					2.0E+00	n	3.0E+00	4.9E-04	n	7.5E-04
				1.0E-03	I					1	0.1		Aldicarb Sulfone	1646-88-4	6.3E+00	n	8.2E+01	n					2.0E+00	n	2.0E+00	4.4E-04	n	4.4E-04
										1	0.1		Aldicarb sulfoxide	1646-87-3											4.0E+00			8.8E-04
1.7E+01	I	4.9E-03	I	3.0E-05	I			V		1			Aldrin	309-00-2	3.9E-02	c**	1.8E-01	c*	5.7E-04	c	2.5E-03	c	9.2E-04	c*		1.5E-04	c*	
				5.0E-03	I	1.0E-04	X	V		1		1.1E+05	Allyl Alcohol	107-18-6	3.5E-01	n	1.5E+00	n	1.0E-02	n	4.4E-02	n	2.1E-02	n		4.2E-06	n	
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	Allyl Chloride	107-05-1	1.7E-01	n	6.9E-01	n	1.00E-01	n	4.40E-01	n	2.1E-01	n		6.7E-05	n	
				1.0E+00	P	5.0E-03	P			1			Aluminum	7429-90-5	7.7E+03	n	1.1E+05	nm	5.2E-01	n	2.2E+00	n	2.0E+03	n		3.0E+03	n	
				4.0E-04	I					1			Aluminum Phosphide	20859-73-8	3.1E+00	n	4.7E+01	n					8.0E-01	n			n	
				9.0E-03	I					1	0.1		Ametryn	834-12-8	5.7E+01	n	7.4E+02	n					1.5E+01	n		1.6E-02	n	
2.1E+01	C	6.0E-03	C							1	0.1		Aminobiphenyl, 4-	92-67-1	2.6E-02	c	1.1E-01	c	4.7E-04	c	2.0E-03	c	3.0E-03	c		1.5E-05	c	
				8.0E-02	P					1	0.1		Aminophenol, m-	591-27-5	5.1E+02	n	6.6E+03	n					1.6E+02	n		6.1E-02	n	
				2.0E-02	P					1	0.1		Aminophenol, p-	123-30-8	1.3E+02	n	1.6E+03	n					4.0E+01	n		1.5E-02	n	
				2.5E-03	I					1	0.1		Amitraz	33089-61-1	1.6E+01	n	2.1E+02	n					8.2E-01	n		4.2E-01	n	
						1.0E-01	I	V		1			Ammonia	7664-41-7					1.0E+01	n	4.4E+01	n						
				2.0E-01	I					1			Ammonium Sulfamate	7773-06-0									4.0E+02	n			n	
						3.0E-03	X	V		1		1.4E+04	Amyl Alcohol, tert-	75-85-4	1.6E+03	n	2.3E+04	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		1.3E-04	n	
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		Aniline	62-53-3	4.4E+01	n	4.0E+02	c**	1.0E-01	n	4.4E-01	n	1.3E+01	c**		4.6E-03	c**	
4.0E-02	P			2.0E-03	X					1	0.1		Anthraquinone, 9,10-	84-65-1	1.3E+01	n	5.7E+01	c**					1.4E+00	c**		1.4E-02	c**	
				4.0E-04	I					0.15			Antimony (metallic)	7440-36-0	3.1E+00	n	4.7E+01	n					7.8E-01	n	6.0E+00	3.5E-02	n	2.7E-01
				5.0E-04	H					0.15			Antimony Pentoxide	1314-60-9	3.9E+00	n	5.8E+01	n					9.7E-01	n			n	
				4.0E-04	H					0.15			Antimony Tetroxide	1332-81-6	3.1E+00	n	4.7E+01	n					7.8E-01	n			n	
						2.0E-04	I			0.15			Antimony Trioxide	1309-64-4	2.8E+04	n	1.2E+05	nm	2.1E-02	n	8.8E-02	n						
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		Arsenic, Inorganic	7440-38-2	6.8E-01	c** R	3.0E+00	c*R	6.5E-04	c**	2.9E-03	c**	5.2E-02	c*	1.0E+01	1.5E-03	c*	2.9E-01
				3.5E-06	C	5.0E-05	I			1			Arsine	7784-42-1	2.7E-02	n	4.1E-01	n	5.2E-03	n	2.2E-02	n	7.0E-03	n			n	
				5.0E-02	I					1	0.1		Asulam	3337-71-1	3.2E+02	n	4.1E+03	n					1.0E+02	n		2.6E-02	n	
2.3E-01	C			3.5E-02	I					1	0.1		Atrazine	1912-24-9	2.4E+00	c*	1.0E+01	c					3.0E-01	c	3.0E+00	2.0E-04	c	1.9E-03
8.8E-01	C	2.5E-04	C							1	0.1		Auramine	492-80-8	6.2E-01	c	2.6E+00	c	1.1E-02	c	4.9E-02	c	6.7E-02	c		6.1E-04	c	
				4.0E-04	I					1	0.1		Avermectin B1	65195-55-3	2.5E+00	n	3.3E+01	n					8.0E-01	n		1.4E+00	n	
				3.0E-03	A	1.0E-02	A			1	0.1		Azinphos-methyl	86-50-0	1.9E+01	n	2.5E+02	n	1.0E+00	n	4.4E+00	n	5.6E+00	n		1.7E-03	n	
1.1E-01	I	3.1E-05	I					V		1			Azobenzene	103-33-3	5.6E+00	c	2.6E+01	c	9.1E-02	c	4.0E-01	c	1.2E-01	c		9.3E-04	c	
				1.0E+00	P	7.0E-06	P			1	0.1		Azodicarbonamide	123-77-3	8.6E+02	n	4.0E+03	n	7.3E-04	n	3.1E-03	n	2.0E+03	n		6.8E-01	n	
				2.0E-01	I	5.0E-04	H			0.07			Barium	7440-39-3	1.5E+03	n	2.2E+04	n	5.2E-02	n	2.2E-01	n	3.8E+02	n	2.0E+03	1.6E+01	n	8.2E+01
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Barium Chromate	10294-40-3	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				3.0E-01	I			V		1			Benfluralin	1861-40-1	2.3E+03	n	3.5E+04	n					1.7E+02	n		5.6E+00	n	
				5.0E-02	I					1	0.1		Benomyl	17804-35-2	3.2E+02	n	4.1E+03	n					9.7E+01	n		8.5E-02	n	
				2.0E-01	I					1	0.1		Bensulfuron-methyl	83055-99-6	1.3E+03	n	1.6E+04	n					3.9E+02	n		1.0E-01	n	
				3.0E-02	I					1	0.1		Bentazon	25057-89-0	1.9E+02	n	2.5E+03	n					5.7E+01	n		1.2E-02	n	
4.0E-03	P			1.0E-01	I			V		1		1.2E+03	Benzaldehyde	100-52-7	1.7E+02	c**	8.2E+02	c*					1.9E+01	c*		4.1E-03	c*	
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	Benzene	71-43-2	1.2E+00	c**	5.1E+00	c**	3.6E-01	c**	1.6E+00	c**	4.6E-01	c**	5.0E+00	2.3E-04	c**	2.6E-03
1.0E-01	X			3.0E-04	X					1	0.1		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	1.9E+00	n	2.3E+01	c**					6.0E-01	n		1.7E-04	n	
				1.0E-03	P			V		1		1.3E+03	Benzenethiol	108-98-5	7.8E+00	n	1.2E+02	n					1.7E+00	n		1.1E-03	n	
2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		Benzidine	92-87-5	5.3E-04	c	1.0E-02	c	1.5E-05	c	1.8E-04	c	1.1E-04	c		2.8E-07	c	
				4.0E+00	I					1	0.1		Benzoic Acid	65-85-0	2.5E+04	n	3.3E+05	nm					7.5E+03	n		1.5E+00	n	
1.3E+01	I							V		1		3.2E+02	Benzotrichloride	98-07-7	5.3E-02	c	2.5E-01	c					3.0E-03	c		6.6E-06	c	
				1.0E-01	P					1	0.1		Benzyl Alcohol	100-51-6	6.3E+02	n	8.2E+03	n					2.0E+02	n		4.8E-02	n	
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	Benzyl Chloride	100-44-7	1.1E+00	c**	4.8E+00	c**	5.7E-02	c**	2.5E-01	c**	8.9E-02	c**		9.8E-05	c**	
		2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			Beryllium and compounds	7440-41-7	1.6E+01	n	2.3E+02	n	1.2E-03	c**	5.1E-03	c**	2.5E+00	n	4.0E+00	1.9E+00	n	3.2E+00
				9.0E-03	P					1	0.1		Bifenox	42576-02-3	5.7E+01	n	7.4E+02	n					1.0E+01	n		7.6E-02	n	
				1.5E-02	I					1	0.1		Biphenthrin	82657-04-3	9.5E+01	n	1.2E+03	n					3.0E+01	n		1.4E+02	n	
8.0E-03	I			5.0E-01	I	4.0E-04	X	V		1			Biphenyl, 1,1'-	92-52-4	4.7E+00	n	2.0E+01	n	4.2E-02	n	1.8E-01	n	8.3E-02	n		8.7E-04	n	
				4.0E-02	I			V		1		1.0E+03	Bis(2-chloro-1-methylethyl) ether	108-60-1	3.1E+02	n	4.7E+03	ns					7.1E+01	n		2.6E-02	n	
				3.0E-03	P					1	0.1		Bis(2-chloroethoxy)methane	111-91-1	1.9E+01	n	2.5E+02	n					5.9E+00	n		1.3E-03	n	
1.1E+00	I	3.3E-04	I					V		1		5.1E+03	Bis(2-chloroethyl)ether	111-44-4	2.3E-01	c	1.0E+00	c	8.5E-03	c	3.7E-02	c	1.4E-02	c		3.6E-06	c	
2.2E+02	I	6.2E-02	I					V		1		4.2E+03	Bis(chloromethyl)ether	542-88-1	8.3E-05	c	3.6E-04	c	4.5E-05	c	2.0E-04	c	7.2E-05	c		1.7E-08	c	
				5.0E-02	I					1	0.1		Bisphenol A	80-05-7	3.2E+02	n	4.1E+03	n					7.7E+01	n		5.8E+00	n	
				2.0E-01	I	2.0E-02	H			1			Boron And Borates Only	7440-42-8	1.6E+03	n	2.3E+04	n	2.1E+00	n	8.8E+00	n	4.0E+02	n		1.3E+00	n	
				2.0E+00	P	2.0E-02	P	V		1			Boron Trichloride	10294-34-5	1.6E+04	n	2.3E+05	nm	2.1E+00	n	8.8E+00	n	4.2E+00	n			n	
				4.0E-02	C	1.3E-02	C	V		1			Boron Trifluoride	7637-07-2	3.1E+02	n	4.7E+03	n	1.4E+00	n	5.7E+00	n	2.6E+00	n			n	
7.0E-01	I			4.0E-03	I					1			Bromate	15541-45-4	9.9E-01	c*	4.7E+00	c					1.1E-01	c*	1.0E+01	8.5E-04	c*	7.7E-02
2.0E+00	X	6.0E-04	X					V		1		2.4E+03	Bromo-2-chloroethane, 1-	107-04-0	2.6E-02	c	1.1E-01	c	4.7E-03	c	2.0E-02	c	7.4E-03	c		2.1E-06	c	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (μg/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (μg/m^3)	key	Industrial Air (μg/m^3)	key	Tapwater (μg/L)	key	MCL (μg/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				8.0E-03	I	6.0E-02	I	V		1		6.8E+02	Bromobenzene	108-86-1	2.9E+01	n	1.8E+02	n	6.3E+00	n	2.6E+01	n	6.2E+00	n		4.2E-03	n	
						4.0E-02	X	V		1		4.0E+03	Bromochloromethane	74-97-5	1.5E+01	n	6.3E+01	n	4.2E+00	n	1.8E+01	n	8.3E+00	n		2.1E-03	n	
6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	Bromodichloromethane	75-27-4	2.9E-01	c	1.3E+00	c	7.6E-02	c	3.3E-01	c	1.3E-01	c	8.0E+01(F)	3.6E-05	c	2.2E-02
7.9E-03	I	1.1E-06	I	2.0E-02	I			V		1		9.2E+02	Bromoform	75-25-2	1.9E+01	c**	8.6E+01	c*	2.6E+00	c	1.1E+01	c	3.3E+00	c*	8.0E+01(F)	8.7E-04	c*	2.1E-02
				1.4E-03	I	5.0E-03	I	V		1		3.6E+03	Bromomethane	74-83-9	6.8E-01	n	3.0E+00	n	5.2E-01	n	2.2E+00	n	7.5E-01	n		1.9E-04	n	
				5.0E-03	H			V		1			Bromophos	2104-96-3	3.9E+01	n	5.8E+02	n					3.5E+00	n		1.5E-02	n	
				2.0E-02	I					1	0.1		Bromoxynil	1689-84-5	1.3E+02	n	1.6E+03	n					3.3E+01	n		2.8E-02	n	
				2.0E-02	I			V		1			Bromoxynil Octanoate	1689-99-2	1.6E+02	n	2.3E+03	n					1.4E+01	n		1.2E-01	n	
3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	Butadiene, 1,3-	106-99-0	5.8E-02	c**	2.6E-01	c**	9.4E-02	c**	4.1E-01	c**	1.8E-02	c*		9.9E-06	c*	
				1.0E-01	I			V		1		7.6E+03	Butanol, N-	71-36-3	7.8E+02	n	1.2E+04	ns					2.0E+02	n		4.1E-02	n	
				2.0E+00	P	3.0E+01	P	V		1		2.1E+04	Butyl alcohol, sec-	78-92-2	1.3E+04	n	1.5E+05	nms	3.1E+03	n	1.3E+04	n	2.4E+03	n		5.0E-01	n	
				5.0E-02	I			V		1			Butylate	2008-41-5	3.9E+02	n	5.8E+03	n					4.6E+01	n		4.5E-02	n	
2.0E-04	C	5.7E-08	C							1	0.1		Butylated hydroxyanisole	25013-16-5	2.7E+03	c	1.1E+04	c	4.9E+01	c	2.2E+02	c	1.5E+02	c		2.9E-01	c	
3.6E-03	P			3.0E-01	P					1	0.1		Butylated hydroxytoluene	128-37-0	1.5E+02	c*	6.4E+02	c*					3.4E+00	c*		1.0E-01	c*	
				5.0E-02	P			V		1		1.1E+02	Butylbenzene, n-	104-51-8	3.9E+02	ns	5.8E+03	ns					1.0E+02	n		3.2E-01	n	
				1.0E-01	X			V		1		1.5E+02	Butylbenzene, sec-	135-98-8	7.8E+02	ns	1.2E+04	ns					2.0E+02	n		5.9E-01	n	
				1.0E-01	X			V		1		1.8E+02	Butylbenzene, tert-	98-06-6	7.8E+02	ns	1.2E+04	ns					6.9E+01	n		1.6E-01	n	
				2.0E-02	A					1	0.1		Cacodylic Acid	75-60-5	1.3E+02	n	1.6E+03	n					4.0E+01	n		1.1E-02	n	
		1.8E-03	I	1.0E-03	I	1.0E-05	A			0.025	0.001		Cadmium (Diet)	7440-43-9	7.1E+00	n	9.8E+01	n										
		1.8E-03	I	5.0E-04	I	1.0E-05	A			0.05	0.001		Cadmium (Water)	7440-43-9					1.0E-03	n	4.4E-03	n	9.2E-01	n	5.0E+00	6.9E-02	n	3.8E-01
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Calcium Chromate	13765-19-0	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				5.0E-01	I	2.2E-03	C			1	0.1		Caprolactam	105-60-2	3.1E+03	n	4.0E+04	n	2.3E-01	n	9.6E-01	n	9.9E+02	n		2.5E-01	n	
1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		Captafol	2425-06-1	3.6E+00	c**	1.5E+01	c*	6.5E-02	c	2.9E-01	c	4.0E-01	c**		7.1E-04	c**	
2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		Captan	133-06-2	2.4E+02	c**	1.0E+03	c*	4.3E+00	c	1.9E+01	c	3.1E+01	c**		2.2E-02	c**	
				1.0E-01	I					1	0.1		Carbaryl	63-25-2	6.3E+02	n	8.2E+03	n					1.8E+02	n		1.7E-01	n	
				5.0E-03	I					1	0.1		Carbofuran	1563-66-2	3.2E+01	n	4.1E+02	n					9.4E+00	n	4.0E+01	3.7E-03	n	1.6E-02
				1.0E-01	I	7.0E-01	I	V		1		7.4E+02	Carbon Disulfide	75-15-0	7.7E+01	n	3.5E+02	n	7.3E+01	n	3.1E+02	n	8.1E+01	n		2.4E-02	n	
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		1		4.6E+02	Carbon Tetrachloride	56-23-5	6.5E-01	c*	2.9E+00	c*	4.7E-01	c*	2.0E+00	c*	4.6E-01	c*	5.0E+00	1.8E-04	c*	1.9E-03
						1.0E-01	P	V		1		5.9E+03	Carbonyl Sulfide	463-58-1	6.7E+00	n	2.8E+01	n	1.0E+01	n	4.4E+01	n	2.1E+01	n		5.1E-02	n	
				1.0E-02	I					1	0.1		Carbosulfan	55285-14-8	6.3E+01	n	8.2E+02	n					5.1E+00	n		1.2E-01	n	
				1.0E-01	I					1	0.1		Carboxin	5234-68-4	6.3E+02	n	8.2E+03	n					1.9E+02	n		1.0E-01	n	
						9.0E-04	I			1			Ceric oxide	1306-38-3	1.3E+05	nm	5.4E+05	nm	9.4E-02	n	3.9E-01	n						
				1.0E-01	I			V		1			Chloral Hydrate	302-17-0	7.8E+02	n	1.2E+04	n					2.0E+02	n		4.0E-02	n	
				1.5E-02	I					1	0.1		Chloramben	133-90-4	9.5E+01	n	1.2E+03	n					2.9E+01	n		7.0E-03	n	
4.0E-01	H									1	0.1		Chloranil	118-75-2	1.3E+00	c	5.7E+00	c					1.8E-01	c		1.5E-04	c	
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	V		1	0.04		Chlordane	12789-03-6	1.7E+00	c**	7.7E+00	c**	2.8E-02	c**	1.2E-01	c**	2.0E-02	c**	2.0E+00	2.7E-03	c**	2.7E-01
1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		Chlordecone (Kepone)	143-50-0	5.4E-02	c*	2.3E-01	c	6.1E-04	c	2.7E-03	c	3.5E-03	c*		1.2E-04	c*	
				7.0E-04	A					1	0.1		Chlorfenvinphos	470 90 6	4.4E+00	n	5.7E+01	n					1.1E+00	n		3.1E-03	n	
				2.0E-02	I					1	0.1		Chlorimuron, Ethyl-	90982-32-4	1.3E+02	n	1.6E+03	n					3.9E+01	n		1.3E-02	n	
				1.0E-01	I	1.5E-04	A	V		1		2.8E+03	Chlorine	7782-50-5	1.8E-02	n	7.8E-02	n	1.5E-02	n	6.4E-02	n	3.0E-02	n		1.4E-05	n	
				3.0E-02	I	2.0E-04	I	V		1			Chlorine Dioxide	10049-04-4	2.3E+02	n	3.4E+03	n	2.1E-02	n	8.8E-02	n	4.2E-02	n			n	
				3.0E-02	I					1			Chlorite (Sodium Salt)	7758-19-2	2.3E+02	n	3.5E+03	n					6.0E+01	n	1.0E+03		n	
						5.0E+01	I	V		1		1.2E+03	Chloro-1,1-difluoroethane, 1-	75-68-3	5.4E+03	ns	2.3E+04	ns	5.2E+03	n	2.2E+04	n	1.0E+04	n		5.2E+00	n	
		3.0E-04	I	2.0E-02	H	2.0E-02	I	V		1		7.9E+02	Chloro-1,3-butadiene, 2-	126-99-8	1.0E-02	c	4.4E-02	c	9.4E-03	c	4.1E-02	c	1.9E-02	c		9.8E-06	c	
4.6E-01	H									1	0.1		Chloro-2-methylaniline HCl, 4-	3165-93-3	1.2E+00	c	5.0E+00	c					1.7E-01	c		1.5E-04	c	
1.0E-01	P	7.7E-05	C	3.0E-03	X					1	0.1		Chloro-2-methylaniline, 4-	95-69-2	5.4E+00	c**	2.3E+01	c*	3.6E-02	c	1.6E-01	c	7.0E-01	c**		4.0E-04	c**	
2.7E-01	X							V		1		1.2E+04	Chloroacetaldehyde, 2-	107-20-0	2.6E+00	c	1.2E+01	c					2.9E-01	c		5.8E-05	c	
										1	0.1		Chloroacetic Acid	79-11-8											6.0E+01			1.2E-02
						3.0E-05	I			1	0.1		Chloroacetophenone, 2-	532-27-4	4.3E+03	n	1.8E+04	n	3.1E-03	n	1.3E-02	n						
2.0E-01	P			4.0E-03	I					1	0.1		Chloroaniline, p-	106-47-8	2.7E+00	c**	1.1E+01	c*					3.7E-01	c*		1.6E-04	c*	
				2.0E-02	I	5.0E-02	P	V		1		7.6E+02	Chlorobenzene	108-90-7	2.8E+01	n	1.3E+02	n	5.2E+00	n	2.2E+01	n	7.8E+00	n	1.0E+02	5.3E-03	n	6.8E-02
1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		Chlorobenzilate	510-15-6	4.9E+00	c*	2.1E+01	c*	9.1E-02	c	4.0E-01	c	3.1E-01	c*		1.0E-03	c*	
				3.0E-02	X					1	0.1		Chlorobenzoic Acid, p-	74-11-3	1.9E+02	n	2.5E+03	n					5.1E+01	n		1.3E-02	n	
				3.0E-03	P	3.0E-01	P	V		1		2.9E+02	Chlorobenzotrifluoride, 4-	98-56-6	2.1E+01	n	2.5E+02	n	3.1E+01	n	1.3E+02	n	3.5E+00	n		1.2E-02	n	
				4.0E-02	P			V		1		7.3E+02	Chlorobutane, 1-	109-69-3	3.1E+02	n	4.7E+03	ns					6.4E+01	n		2.6E-02	n	
						5.0E+01	I	V		1		1.7E+03	Chlorodifluoromethane	75-45-6	4.9E+03	ns	2.1E+04	ns	5.2E+03	n	2.2E+04	n	1.0E+04	n		4.3E+00	n	
				2.0E-02	P			V		1		1.1E+05	Chloroethanol, 2-	107-07-3	1.6E+02	n	2.3E+03	n					4.0E+01	n		8.1E-03	n	
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	Chloroform	67-66-3	3.2E-01	c*	1.4E+00	c*	1.2E-01	c*	5.3E-01	c*	2.2E-01	c*	8.0E+01(F)	6.1E-05	c*	2.2E-02
						9.0E-02	I	V		1		1.3E+03	Chloromethane	74-87-3	1.1E+01	n	4.6E+01	n	9.4E+00	n	3.9E+01	n	1.9E+01	n		4.9E-03	n	
2.4E+00	C	6.9E-04	C					V		1		9.3E+03	Chloromethyl Methyl Ether	107-30-2	2.0E-02	c	8.9E-02	c	4.1E-03	c	1.8E-02	c	6.5E-03	c		1.4E-06	c	
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		Chloronitrobenzene, o-	88-73-3	1.8E+00	c*	7.7E+00	c*	1.0E-03	n	4.4E-03	n	2.4E-01	c*		2.2E-04	c*	
6.0E-02	P			7.0E-04	P	2.0E-03	P			1	0.1		Chloronitrobenzene, p-	100-00-5	4.4E+00	n	3.8E+01	c**	2.1E-01	n	8.8E-01	n	1.2E+00	c**		1.1E-03	c**	
				5.0E-03	I			V		1		2.7E+04	Chlorophenol, 2-	95-57-8	3.9E+01	n	5.8E+02	n					9.1E+00	n		8.9E-03	n	
						4.0E-04	C	V		1		6.2E+02	Chloropicrin	76-06-2	2.0E-01	n	8.2E-01	n	4.2E-02	n	1.8E-01	n	8.3E-02	n		2.5E-05	n	
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		Chlorothalonil	1897-45-6	9.5E+01	n	7.4E+02	c**	3.2E+00	c	1.4E+01	c	2.2E+01	c**		5.0E-02	c**	
				2.0E-02	I			V		1		9.1E+02	Chlorotoluene, o-	95-49-8	1.6E+02	n	2.3E+03	ns					2.4E+01	n		2.3E-02	n	
				2.0E-02	X			V		1		2.5E+02	Chlorotoluene, p-	106-43-4	1.6E+02	n	2.3E+03	ns					2.5E+01	n		2.4E-02	n	
2.4E+02	C	6.9E-02	C							1	0.1		Chlorozotocin	54749-90-5	2.3E-03	c	9.6E-03	c	4.1E-05	c	1.8E-04	c	3.2E-04	c		7.1E-08	c	
				2.0E-01	I					1	0.1		Chlorpropham	101-21-3	1.3E+03	n	1.6E+04	n					2.8E+02	n		2.6E-01	n	
				1.0E-03	A					1	0.1		Chlorpyrifos	2921-88-2	6.3E+00	n	8.2E+01	n					8.4E-01	n		1.2E-02	n	
				1.0E-02	H					1	0.1		Chlorpyrifos Methyl	5598-13-0	6.3E+01	n	8.2E+02	n					1.2E+01	n		5.4E-02	n	
				5.0E-02	I					1	0.1		Chlorsulfuron	64902-72-3	3.2E+02	n	4.1E+03	n					9.9E+01	n		8.3E-02	n	
				1.0E-02	I					1	0.1		Chlorthal-dimethyl	1861-32-1	6.3E+01	n	8.2E+02	n					1.2E+01	n		1.5E-02	n	
				8.0E-04	H					1	0.1		Chlorthiophos	60238-56-4	5.1E+00	n	6.6E+01	n					2.8E-01	n		7.3E-03	n	
				1.5E+00	I					0.013			Chromium(III), Insoluble Salts	16065-83-1	1.2E+04	n	1.8E+05	nm					2.2E+03	n		4.0E+06	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels													Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (μg/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (μg/m^3)	key	Industrial Air (μg/m^3)	key	Tapwater (μg/L)	key	MCL (μg/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I		M	0.025			Chromium(VI)	18540-29-9	3.0E-01	c*	6.3E+00	c*	1.2E-05	c	1.5E-04	c	3.5E-02	c		6.7E-04	c	
										0.013			Chromium, Total	7440-47-3											1.0E+02			1.8E+05
				1.3E-02	I					1	0.1		Clofentezine	74115-24-5	8.2E+01	n	1.1E+03	n					2.3E+01	n		1.4E+00	n	
		9.0E-03	P	3.0E-04	P	6.0E-06	P			1			Cobalt	7440-48-4	2.3E+00	n	3.5E+01	n	3.1E-04	c**	1.4E-03	c**	6.0E-01	n		2.7E-02	n	
		6.2E-04	I					V	M	1			Coke Oven Emissions	8007-45-2					1.6E-03	c	2.0E-02	c						
				4.0E-02	H					1			Copper	7440-50-8	3.1E+02	n	4.7E+03	n					8.0E+01	n	1.3E+03	2.8E+00	n	4.6E+01
				5.0E-02	I	6.0E-01	C			1	0.1		Cresol, m-	108-39-4	3.2E+02	n	4.1E+03	n	6.3E+01	n	2.6E+02	n	9.3E+01	n		7.4E-02	n	
				5.0E-02	I	6.0E-01	C			1	0.1		Cresol, o-	95-48-7	3.2E+02	n	4.1E+03	n	6.3E+01	n	2.6E+02	n	9.3E+01	n		7.5E-02	n	
				1.0E-01	A	6.0E-01	C			1	0.1		Cresol, p-	106-44-5	6.3E+02	n	8.2E+03	n	6.3E+01	n	2.6E+02	n	1.9E+02	n		1.5E-01	n	
				1.0E-01	A					1	0.1		Cresol, p-chloro-m-	59-50-7	6.3E+02	n	8.2E+03	n					1.4E+02	n		1.7E-01	n	
				1.0E-01	A	6.0E-01	C			1	0.1		Cresols	1319-77-3	6.3E+02	n	8.2E+03	n	6.3E+01	n	2.6E+02	n	1.5E+02	n		1.3E-01	n	
1.9E+00	H			1.0E-03	P			V		1		1.7E+04	Crotonaldehyde, trans-	123-73-9	3.7E-01	c*	1.7E+00	c*					4.0E-02	c*		8.2E-06	c*	
				1.0E-01	I	4.0E-01	I	V		1		2.7E+02	Cumene	98-82-8	1.9E+02	n	9.9E+02	ns	4.2E+01	n	1.8E+02	n	4.5E+01	n		7.4E-02	n	
2.2E-01	C	6.3E-05	C							1	0.1		Cupferron	135-20-6	2.5E+00	c	1.0E+01	c	4.5E-02	c	1.9E-01	c	3.5E-01	c		6.1E-04	c	
8.4E-01	H			2.0E-03	H					1	0.1		Cyanazine	21725-46-2	6.5E-01	c*	2.7E+00	c*					8.8E-02	c*		4.1E-05	c*	
													Cyanides															
				1.0E-03	I					1			~Calcium Cyanide	592-01-8	7.8E+00	n	1.2E+02	n					2.0E+00	n			n	
				5.0E-03	I					1			~Copper Cyanide	544-92-3	3.9E+01	n	5.8E+02	n					1.0E+01	n			n	
				6.0E-04	I	8.0E-04	S	V		1		9.5E+05	~Cyanide (CN-)	57-12-5	2.3E+00	n	1.5E+01	n	8.3E-02	n	3.5E-01	n	1.5E-01	n	2.0E+02	1.5E-03	n	2.0E+00
				1.0E-03	I			V		1			~Cyanogen	460-19-5	7.8E+00	n	1.2E+02	n					2.0E+00	n			n	
				9.0E-02	I			V		1			~Cyanogen Bromide	506-68-3	7.0E+02	n	1.1E+04	n					1.8E+02	n			n	
				5.0E-02	I			V		1			~Cyanogen Chloride	506-77-4	3.9E+02	n	5.8E+03	n					1.0E+02	n			n	
				6.0E-04	I	8.0E-04	I	V		1		1.0E+07	~Hydrogen Cyanide	74-90-8	2.3E+00	n	1.5E+01	n	8.3E-02	n	3.5E-01	n	1.5E-01	n		1.5E-03	n	
				2.0E-03	I					1			~Potassium Cyanide	151-50-8	1.6E+01	n	2.3E+02	n					4.0E+00	n			n	
				5.0E-03	I					0.04			~Potassium Silver Cyanide	506-61-6	3.9E+01	n	5.8E+02	n					8.2E+00	n			n	
				1.0E-01	I					0.04			~Silver Cyanide	506-64-9	7.8E+02	n	1.2E+04	n					1.8E+02	n			n	
				1.0E-03	I					1			~Sodium Cyanide	143-33-9	7.8E+00	n	1.2E+02	n					2.0E+00	n	2.0E+02		n	
				2.0E-04	P					1			~Thiocyanates	NA	1.6E+00	n	2.3E+01	n					4.0E-01	n			n	
				2.0E-04	X			V		1			~Thiocyanic Acid	463-56-9	1.6E+00	n	2.3E+01	n					4.0E-01	n			n	
				5.0E-02	I					1			~Zinc Cyanide	557-21-1	3.9E+02	n	5.8E+03	n					1.0E+02	n			n	
						6.0E+00	I	V		1		1.2E+02	Cyclohexane	110-82-7	6.5E+02	ns	2.7E+03	ns	6.3E+02	n	2.6E+03	n	1.3E+03	n		1.3E+00	n	
2.3E-02	H									1	0.1		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.4E+01	c	1.0E+02	c					2.4E+00	c		1.4E-02	c	
				5.0E+00	I	7.0E-01	P	V		1		5.1E+03	Cyclohexanone	108-94-1	2.8E+03	n	1.3E+04	ns	7.3E+01	n	3.1E+02	n	1.4E+02	n		3.4E-02	n	
				5.0E-03	P	1.0E+00	X	V		1		2.8E+02	Cyclohexene	110-83-8	3.1E+01	n	3.1E+02	ns	1.0E+02	n	4.4E+02	n	7.0E+00	n		4.6E-03	n	
				2.0E-01	I			V		1		2.9E+05	Cyclohexylamine	108-91-8	1.6E+03	n	2.3E+04	n					3.8E+02	n		1.0E-01	n	
				2.5E-02	I					1	0.1		Cyfluthrin	68359-37-5	1.6E+02	n	2.1E+03	n					1.2E+01	n		3.1E+00	n	
				5.0E-03	I					1	0.1		Cyhalothrin	68085-85-8	3.2E+01	n	4.1E+02	n					1.0E+01	n		6.8E+00	n	
				1.0E-02	I					1	0.1		Cypermethrin	52315-07-8	6.3E+01	n	8.2E+02	n					2.0E+01	n		3.2E+00	n	
				7.5E-03	I					1	0.1		Cyromazine	66215-27-8	4.7E+01	n	6.2E+02	n					1.5E+01	n		3.8E-03	n	
2.4E-01	I	6.9E-05	C							1	0.1		DDD	72-54-8	2.3E+00	c	9.6E+00	c	4.1E-02	c	1.8E-01	c	3.2E-02	c		7.5E-03	c	
3.4E-01	I	9.7E-05	C					V		1			DDE, p,p'-	72-55-9	2.0E+00	c	9.3E+00	c	2.9E-02	c	1.3E-01	c	4.6E-02	c		1.1E-02	c	
3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		DDT	50-29-3	1.9E+00	c**	8.5E+00	c**	2.9E-02	c	1.3E-01	c	2.3E-01	c**		7.7E-02	c**	
				3.0E-02	I					1	0.1		Dalapon	75-99-0	1.9E+02	n	2.5E+03	n					6.0E+01	n	2.0E+02	1.2E-02	n	4.1E-02
1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		Daminozide	1596-84-5	3.0E+01	c*	1.3E+02	c*	5.5E-01	c	2.4E+00	c	4.3E+00	c*		9.5E-04	c*	
7.0E-04	I			7.0E-03	I					1	0.1		Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	4.4E+01	n	5.7E+02	n					1.4E+01	n		7.8E+00	n	
				4.0E-05	I					1	0.1		Demeton	8065-48-3	2.5E-01	n	3.3E+00	n					4.2E-02	n			n	
1.2E-03	I			6.0E-01	I					1	0.1		Di(2-ethylhexyl)adipate	103-23-1	4.5E+02	c**	1.9E+03	c*					6.5E+01	c*	4.0E+02	4.7E+00	c*	2.9E+01
6.1E-02	H									1	0.1		Diallate	2303-16-4	8.9E+00	c	3.8E+01	c					5.4E-01	c		8.0E-04	c	
				7.0E-04	A					1	0.1		Diazinon	333-41-5	4.4E+00	n	5.7E+01	n					1.0E+00	n		6.5E-03	n	
				1.0E-02	X			V		1			Dibenzothiophene	132-65-0	7.8E+01	n	1.2E+03	n					6.5E+00	n		1.2E-01	n	
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	Dibromo-3-chloropropane, 1,2-	96-12-8	5.3E-03	c*	6.4E-02	c*	1.7E-04	c	2.0E-03	c*	3.3E-04	c	2.0E-01	1.4E-07	c	8.6E-05
				4.0E-04	X			V		1		1.6E+02	Dibromobenzene, 1,3-	108-36-1	3.1E+00	n	4.7E+01	n					5.3E-01	n		5.1E-04	n	
				1.0E-02	I			V		1			Dibromobenzene, 1,4-	106-37-6	7.8E+01	n	1.2E+03	n					1.3E+01	n		1.2E-02	n	
8.4E-02	I			2.0E-02	I			V		1		8.0E+02	Dibromochloromethane	124-48-1	8.3E+00	c*	3.9E+01	c*					8.7E-01	c*	8.0E+01(F)	2.3E-04	c*	2.1E-02
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	Dibromoethane, 1,2-	106-93-4	3.6E-02	c	1.6E-01	c	4.7E-03	c	2.0E-02	c	7.5E-03	c	5.0E-02	2.1E-06	c	1.4E-05
						4.0E-03	X	V		1		2.8E+03	Dibromomethane (Methylene Bromide)	74-95-3	2.4E+00	n	9.9E+00	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		2.1E-04	n	
				3.0E-04	P					1	0.1		Dibutyltin Compounds	NA	1.9E+00	n	2.5E+01	n					6.0E-01	n			n	
				3.0E-02	I					1	0.1		Dicamba	1918-00-9	1.9E+02	n	2.5E+03	n					5.7E+01	n		1.5E-02	n	
		4.2E-03	P					V		1		5.5E+02	Dichloro-2-butene, 1,4-	764-41-0	2.1E-03	c	9.4E-03	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.6E-07	c	
		4.2E-03	P					V		1		5.2E+02	Dichloro-2-butene, cis-1,4-	1476-11-5	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
		4.2E-03	P					V		1		7.6E+02	Dichloro-2-butene, trans-1,4-	110-57-6	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
5.0E-02	I			4.0E-03	I					1	0.1		Dichloroacetic Acid	79-43-6	1.1E+01	c**	4.6E+01	c**					1.5E+00	c**	6.0E+01	3.1E-04	c**	1.2E-02
				9.0E-02	I	2.0E-01	H	V		1		3.8E+02	Dichlorobenzene, 1,2-	95-50-1	1.8E+02	n	9.3E+02	ns	2.1E+01	n	8.8E+01	n	3.0E+01	n	6.0E+02	3.0E-02	n	5.8E-01
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			Dichlorobenzene, 1,4-	106-46-7	2.6E+00	c	1.1E+01	c	2.6E-01	c	1.1E+00	c	4.8E-01	c	7.5E+01	4.6E-04	c	7.2E-02
4.5E-01	I	3.4E-04	C							1	0.1		Dichlorobenzidine, 3,3'-	91-94-1	1.2E+00	c	5.1E+00	c	8.3E-03	c	3.6E-02	c	1.3E-01	c		8.2E-04	c	
				9.0E-03	X					1	0.1		Dichlorobenzophenone, 4,4'-	90-98-2	5.7E+01	n	7.4E+02	n					7.8E+00	n		4.7E-02	n	
				2.0E-01	I	1.0E-01	X	V		1		8.5E+02	Dichlorodifluoromethane	75-71-8	8.7E+00	n	3.7E+01	n	1.0E+01	n	4.4E+01	n	2.0E+01	n		3.0E-02	n	
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	Dichloroethane, 1,1-	75-34-3	3.6E+00	c	1.6E+01	c	1.8E+00	c	7.7E+00	c	2.8E+00	c		7.8E-04	c	
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		1		3.0E+03	Dichloroethane, 1,2-	107-06-2	4.6E-01	c**	2.0E+00	c**	1.1E-01	c**	4.7E-01	c**	1.7E-01	c**	5.0E+00	4.8E-05	c**	1.4E-03
				5.0E-02	I	2.0E-01	I	V		1		1.2E+03	Dichloroethylene, 1,1-	75-35-4	2.3E+01	n	1.0E+02	n	2.1E+01	n	8.8E+01	n	2.8E+01	n	7.0E+00	1.0E-02	n	2.5E-03
				2.0E-03	I			V		1		2.4E+03	Dichloroethylene, 1,2-cis-	156-59-2	1.6E+01	n	2.3E+02	n					3.6E+00	n	7.0E+01	1.1E-03	n	2.1E-02
				2.0E-02	I			V		1		1.9E+03	Dichloroethylene, 1,2-trans-	156-60-5	1.6E+02	n	2.3E+03	ns					3.6E+01	n	1.0E+02	1.1E-02	n	3.1E-02
				3.0E-03	I					1	0.1		Dichlorophenol, 2,4-	120-83-2	1.9E+01	n	2.5E+02	n					4.6E+00	n		2.3E-03	n	
				1.0E-02	I					1	0.05		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	7.0E+01	n	9.6E+02	n					1.7E+01	n	7.0E+01	4.5E-03	n	1.8E-02
				8.0E-03	I					1	0.1		Dichlorophenoxy)butyric Acid, 4-(2,4-	94-82-6	5.1E+01	n	6.6E+02	n					1.2E+01	n		1.1E-02	n	

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Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day)$^{-1}$	key	IUR (μg/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (μg/m^3)	key	Industrial Air (μg/m^3)	key	Tapwater (μg/L)	key	MCL (μg/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	Dichloropropane, 1,2-	78-87-5	1.0E+00	c**	4.4E+00	c**	2.8E-01	c**	1.2E+00	c**	4.4E-01	c**	5.0E+00	1.5E-04	c**	1.7E-03
				2.0E-02	P			V		1		1.5E+03	Dichloropropane, 1,3-	142-28-9	1.6E+02	n	2.3E+03	ns					3.7E+01	n		1.3E-02	n		
				3.0E-03	I					1	0.1		Dichloropropanol, 2,3-	616-23-9	1.9E+01	n	2.5E+02	n					5.9E+00	n		1.3E-03	n		
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	Dichloropropene, 1,3-	542-75-6	1.8E+00	c**	8.2E+00	c**	7.0E-01	c**	3.1E+00	c**	4.7E-01	c**		1.7E-04	c**		
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		Dichlorvos	62-73-7	1.9E+00	c**	7.9E+00	c**	3.4E-02	c**	1.5E-01	c**	2.6E-01	c**		8.1E-05	c**		
				1.0E-04	I					1	0.1		Dicrotophos	141-66-2	6.3E-01	n	8.2E+00	n					2.0E-01	n		4.7E-05	n		
				8.0E-02	P	3.0E-04	X	V		1		2.6E+02	Dicyclopentadiene	77-73-6	1.3E-01	n	5.4E-01	n	3.1E-02	n	1.3E-01	n	6.3E-02	n		2.2E-04	n		
1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		Dieldrin	60-57-1	3.4E-02	c**	1.4E-01	c*	6.1E-04	c	2.7E-03	c	1.8E-03	c*		7.1E-05	c*		
		3.0E-04	C			5.0E-03	I			1	0.1		Diesel Engine Exhaust	NA					9.4E-03	c*	4.1E-02	c*							
				2.0E-03	P	2.0E-04	P			1	0.1		Diethanolamine	111-42-2	1.3E+01	n	1.6E+02	n	2.1E-02	n	8.8E-02	n	4.0E+00	n		8.1E-04	n		
				3.0E-02	P	1.0E-04	P			1	0.1		Diethylene Glycol Monobutyl Ether	112-34-5	1.9E+02	n	2.4E+03	n	1.0E-02	n	4.4E-02	n	6.0E+01	n		1.3E-02	n		
				6.0E-02	P	3.0E-04	P			1	0.1		Diethylene Glycol Monoethyl Ether	111-90-0	3.8E+02	n	4.8E+03	n	3.1E-02	n	1.3E-01	n	1.2E+02	n		2.4E-02	n		
				1.0E-03	P			V		1		1.1E+05	Diethylformamide	617-84-5	7.8E+00	n	1.2E+02	n					2.0E+00	n		4.1E-04	n		
3.5E+02	C	1.0E-01	C							1	0.1		Diethylstilbestrol	56-53-1	1.6E-03	c	6.6E-03	c	2.8E-05	c	1.2E-04	c	5.1E-05	c		2.8E-05	c		
				8.0E-02	I					1	0.1		Difenzoquat	43222-48-6	5.1E+02	n	6.6E+03	n					1.6E+02	n		2.5E+01	n		
				2.0E-02	I					1	0.1		Diflubenzuron	35367-38-5	1.3E+02	n	1.6E+03	n					2.9E+01	n		3.3E-02	n		
						4.0E+01	I	V		1		1.4E+03	Difluoroethane, 1,1-	75-37-6	4.8E+03	ns	2.0E+04	ns	4.2E+03	n	1.8E+04	n	8.3E+03	n		2.8E+00	n		
4.4E-02	C	1.3E-05	C					V		1			Dihydrosafrole	94-58-6	9.9E+00	c	4.5E+01	c	2.2E-01	c	9.4E-01	c	3.0E-01	c		1.9E-04	c		
						7.0E-01	P	V		1		2.3E+03	Diisopropyl Ether	108-20-3	2.2E+02	n	9.4E+02	n	7.3E+01	n	3.1E+02	n	1.5E+02	n		3.7E-02	n		
				8.0E-02	I			V		1		5.3E+02	Diisopropyl Methylphosphonate	1445-75-6	6.3E+02	ns	9.3E+03	ns					1.6E+02	n		4.5E-02	n		
				2.0E-02	I					1	0.1		Dimethipin	55290-64-7	1.3E+02	n	1.6E+03	n					4.0E+01	n		8.8E-03	n		
				2.0E-04	I					1	0.1		Dimethoate	60-51-5	1.3E+00	n	1.6E+01	n					4.0E-01	n		9.0E-05	n		
1.6E+00	P									1	0.1		Dimethoxybenzidine, 3,3'-	119-90-4	3.4E-01	c	1.4E+00	c					4.7E-02	c		5.8E-05	c		
1.7E-03	P			6.0E-02	P					1	0.1		Dimethyl methylphosphonate	756-79-6	3.2E+02	c**	1.4E+03	c**					4.6E+01	c**		9.6E-03	c**		
4.6E+00	C	1.3E-03	C							1	0.1		Dimethylamino azobenzene [p-]	60-11-7	1.2E-01	c	5.0E-01	c	2.2E-03	c	9.4E-03	c	5.0E-03	c		2.1E-05	c		
5.8E-01	H									1	0.1		Dimethylaniline HCl, 2,4-	21436-96-4	9.4E-01	c	4.0E+00	c					1.3E-01	c		1.2E-04	c		
2.0E-01	P			2.0E-03	X					1	0.1		Dimethylaniline, 2,4-	95-68-1	2.7E+00	c**	1.1E+01	c*					3.7E-01	c*		2.1E-04	c*		
				2.0E-03	I			V		1		8.3E+02	Dimethylaniline, N,N-	121-69-7	1.6E+01	n	2.3E+02	n					3.5E+00	n		1.3E-03	n		
1.1E+01	P									1	0.1		Dimethylbenzidine, 3,3'-	119-93-7	4.9E-02	c	2.1E-01	c					6.5E-03	c		4.3E-05	c		
				1.0E-01	P	3.0E-02	I	V		1		1.1E+05	Dimethylformamide	68-12-2	2.6E+02	n	1.5E+03	n	3.1E+00	n	1.3E+01	n	6.1E+00	n		1.2E-03	n		
				1.0E-04	X	2.0E-06	X	V		1		1.7E+05	Dimethylhydrazine, 1,1-	57-14-7	5.7E-03	n	2.4E-02	n	2.1E-04	n	8.8E-04	n	4.2E-04	n		9.3E-08	n		
5.5E+02	C	1.6E-01	C					V		1		1.9E+05	Dimethylhydrazine, 1,2-	540-73-8	8.8E-04	c	4.1E-03	c	1.8E-05	c	7.7E-05	c	2.8E-05	c		6.5E-09	c		
				2.0E-02	I					1	0.1		Dimethylphenol, 2,4-	105-67-9	1.3E+02	n	1.6E+03	n					3.6E+01	n		4.2E-02	n		
				6.0E-04	I					1	0.1		Dimethylphenol, 2,6-	576-26-1	3.8E+00	n	4.9E+01	n					1.1E+00	n		1.3E-03	n		
				1.0E-03	I					1	0.1		Dimethylphenol, 3,4-	95-65-8	6.3E+00	n	8.2E+01	n					1.8E+00	n		2.1E-03	n		
4.5E-02	C	1.3E-05	C					V		1		4.7E+02	Dimethylvinylchloride	513-37-1	1.1E+00	c	4.8E+00	c	2.2E-01	c	9.4E-01	c	3.3E-01	c		1.1E-04	c		
				8.0E-05	X					1	0.1		Dinitro-o-cresol, 4,6-	534-52-1	5.1E-01	n	6.6E+00	n					1.5E-01	n		2.6E-04	n		
				2.0E-03	I					1	0.1		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	1.3E+01	n	1.6E+02	n					2.3E+00	n		7.7E-02	n		
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,2-	528-29-0	6.3E-01	n	8.2E+00	n					1.9E-01	n		1.8E-04	n		
				1.0E-04	I					1	0.1		Dinitrobenzene, 1,3-	99-65-0	6.3E-01	n	8.2E+00	n					2.0E-01	n		1.8E-04	n		
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,4-	100-25-4	6.3E-01	n	8.2E+00	n					2.0E-01	n		1.8E-04	n		
				2.0E-03	I					1	0.1		Dinitrophenol, 2,4-	51-28-5	1.3E+01	n	1.6E+02	n					3.9E+00	n		4.4E-03	n		
6.8E-01	I									1	0.1		Dinitrotoluene Mixture, 2,4/2,6-	NA	8.0E-01	c	3.4E+00	c					1.1E-01	c		1.5E-04	c		
3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		Dinitrotoluene, 2,4-	121-14-2	1.7E+00	c**	7.4E+00	c*	3.2E-02	c	1.4E-01	c	2.4E-01	c*		3.2E-04	c*		
1.5E+00	P			3.0E-04	X					1	0.099		Dinitrotoluene, 2,6-	606-20-2	3.6E-01	c**	1.5E+00	c*					4.9E-02	c*		6.7E-05	c*		
				2.0E-03	S					1	0.006		Dinitrotoluene, 2-Amino-4,6-	35572-78-2	1.5E+01	n	2.3E+02	n					3.9E+00	n		3.0E-03	n		
				2.0E-03	S					1	0.009		Dinitrotoluene, 4-Amino-2,6-	19406-51-0	1.5E+01	n	2.3E+02	n					3.9E+00	n		3.0E-03	n		
4.5E-01	X			9.0E-04	X					1	0.1		Dinitrotoluene, Technical grade	25321-14-6	1.2E+00	c**	5.1E+00	c*					1.0E-01	c*		1.4E-04	c*		
				1.0E-03	I					1	0.1		Dinoseb	88-85-7	6.3E+00	n	8.2E+01	n					1.5E+00	n	7.0E+00	1.3E-02	n	6.2E-02	
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	V		1		1.2E+05	Dioxane, 1,4-	123-91-1	5.3E+00	c*	2.4E+01	c*	5.6E-01	c**	2.5E+00	c**	4.6E-01	c*		9.4E-05	c*		
													Dioxins																	
6.2E+03	I	1.3E+00	I							1	0.03		~Hexachlorodibenzo-p-dioxin, Mixture	NA	1.0E-04	c	4.7E-04	c	2.2E-06	c	9.4E-06	c	1.3E-05	c		1.7E-05	c		
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C	V		1	0.03		~TCDD, 2,3,7,8-	1746-01-6	4.8E-06	c**	2.2E-05	c**	7.4E-08	c*	3.2E-07	c*	1.2E-07	c*	3.0E-05	5.9E-08	c*	1.5E-05
				3.0E-02	I					1	0.1		Diphenamid	957-51-7	1.9E+02	n	2.5E+03	n					5.3E+01	n		5.2E-01	n		
				8.0E-04	X					1	0.1		Diphenyl Sulfone	127-63-9	5.1E+00	n	6.6E+01	n					1.5E+00	n		3.6E-03	n		
				2.5E-02	I					1	0.1		Diphenylamine	122-39-4	1.6E+02	n	2.1E+03	n					3.1E+01	n		5.8E-02	n		
8.0E-01	I	2.2E-04	I							1	0.1		Diphenylhydrazine, 1,2-	122-66-7	6.8E-01	c	2.9E+00	c	1.3E-02	c	5.6E-02	c	7.8E-02	c		2.5E-04	c		
				2.2E-03	I					1	0.1		Diquat	85-00-7	1.4E+01	n	1.8E+02	n					4.4E+00	n	2.0E+01	8.3E-02	n	3.7E-01	
7.1E+00	C	1.4E-01	C							1	0.1		Direct Black 38	1937-37-7	7.6E-02	c	3.2E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		5.3E+00	c		
7.4E+00	C	1.4E-01	C							1	0.1		Direct Blue 6	2602-46-2	7.3E-02	c	3.1E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		1.7E+01	c		
6.7E+00	C	1.4E-01	C							1	0.1		Direct Brown 95	16071-86-6	8.1E-02	c	3.4E-01	c	2.0E-05	c	8.8E-05	c	1.2E-02	c		1.6E-01	c		
				4.0E-05	I					1	0.1		Disulfoton	298-04-4	2.5E-01	n	3.3E+00	n					5.0E-02	n		9.4E-05	n		
				1.0E-02	I			V		1			Dithiane, 1,4-	505-29-3	7.8E+01	n	1.2E+03	n					2.0E+01	n		9.7E-03	n		
				2.0E-03	I					1	0.1		Diuron	330-54-1	1.3E+01	n	1.6E+02	n					3.6E+00	n		1.5E-03	n		
				4.0E-03	I					1	0.1		Dodine	2439-10-3	2.5E+01	n	3.3E+02	n					8.0E+00	n		4.1E-02	n		
				2.5E-02	I			V		1			EPTC	759-94-4	2.0E+02	n	2.9E+03	n					3.8E+01	n		2.0E-02	n		
				6.0E-03	I			V		1			Endosulfan	115-29-7	4.7E+01	n	7.0E+02	n					1.0E+01	n		1.4E-01	n		
				2.0E-02	I					1	0.1		Endothall	145-73-3	1.3E+02	n	1.6E+03	n					3.8E+01	n	1.0E+02	9.1E-03	n	2.4E-02	
				3.0E-04	I					1	0.1		Endrin	72-20-8	1.9E+00	n	2.5E+01	n					2.3E-01	n	2.0E+00	9.2E-03	n	8.1E-02	
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	Epichlorohydrin	106-89-8	1.9E+00	n	8.2E+00	n	1.0E-01	n	4.4E-01	n	2.0E-01	n		4.5E-05	n		
						2.0E-02	I	V		1		1.5E+04	Epoxybutane, 1,2-	106-88-7	1.6E+01	n	6.7E+01	n	2.1E+00	n	8.8E+00	n	4.2E+00	n		9.2E-04	n		
				4.0E-02	P					1	0.1		Ethanol, 2-(2-methoxyethoxy)-	111-77-3	2.5E+02	n	3.3E+03	n					8.0E+01	n		1.6E-02	n		
				5.0E-03	I					1	0.1		Ethephon	16672-87-0	3.2E+01	n	4.1E+02	n					1.0E+01	n		2.1E-03	n		
				5.0E-04	I					1	0.1		Ethion	563-12-2	3.2E+00	n	4.1E+01	n					4.3E-01	n		8.5E-04	n		
				1.0E-01	P	6.0E-02	P	V		1		2.4E+04	Ethoxyethanol Acetate, 2-	111-15-9	2.6E+02	n	1.4E+03	n	6.3E+00	n	2.6E+01	n	1.2E+01	n		2.5E-03	n		

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Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				9.0E-02	P	2.0E-01	I	V		1		1.1E+05	Ethoxyethanol, 2-	110-80-5	5.2E+02	n	4.7E+03	n	2.1E+01	n	8.8E+01	n	3.4E+01	n		6.8E-03	n		
				9.0E-01	I	7.0E-02	P	V		1		1.1E+04	Ethyl Acetate	141-78-6	6.2E+01	n	2.6E+02	n	7.3E+00	n	3.1E+01	n	1.4E+01	n		3.1E-03	n		
				5.0E-03	P	8.0E-03	P	V		1		2.5E+03	Ethyl Acrylate	140-88-5	4.7E+00	n	2.1E+01	n	8.3E-01	n	3.5E+00	n	1.4E+00	n		3.2E-04	n		
						1.0E+01	I	V		1		2.1E+03	Ethyl Chloride (Chloroethane)	75-00-3	1.4E+03	n	5.7E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		5.9E-01	n		
				2.0E-01	I			V		1		1.0E+04	Ethyl Ether	60-29-7	1.6E+03	n	2.3E+04	ns					3.9E+02	n		8.8E-02	n		
						3.0E-01	P	V		1		1.1E+03	Ethyl Methacrylate	97-63-2	1.8E+02	n	7.6E+02	n	3.1E+01	n	1.3E+02	n	6.3E+01	n		1.5E-02	n		
				1.0E-05	I					1	0.1		Ethyl-p-nitrophenyl Phosphonate	2104-64-5	6.3E-02	n	8.2E-01	n					8.9E-03	n		2.8E-04	n		
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	Ethylbenzene	100-41-4	5.8E+00	c*	2.5E+01	c*	1.1E+00	c*	4.9E+00	c*	1.5E+00	c*	7.0E+02	1.7E-03	c*	7.8E-01	
				7.0E-02	P					1	0.1		Ethylene Cyanohydrin	109-78-4	4.4E+02	n	5.7E+03	n					1.4E+02	n		2.8E-02	n		
				9.0E-02	P			V		1		1.9E+05	Ethylene Diamine	107-15-3	7.0E+02	n	1.1E+04	n					1.8E+02	n		4.1E-02	n		
				2.0E+00	I	4.0E-01	C			1	0.1		Ethylene Glycol	107-21-1	1.3E+04	n	1.6E+05	nm	4.2E+01	n	1.8E+02	n	4.0E+03	n		8.1E-01	n		
				1.0E-01	I	1.6E+00	I			1	0.1		Ethylene Glycol Monobutyl Ether	111-76-2	6.3E+02	n	8.2E+03	n	1.7E+02	n	7.0E+02	n	2.0E+02	n		4.1E-02	n		
3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	Ethylene Oxide	75-21-8	1.8E-01	c	7.9E-01	c	3.2E-02	c*	1.4E-01	c*	5.1E-02	c		1.1E-05	c		
4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		Ethylene Thiourea	96-45-7	5.1E-01	n	6.6E+00	n	2.2E-01	c	9.4E-01	c	1.6E-01	n		3.6E-05	n		
6.5E+01	C	1.9E-02	C					V		1		1.5E+05	Ethyleneimine	151-56-4	2.7E-03	c	1.2E-02	c	1.5E-04	c	6.5E-04	c	2.4E-04	c		5.2E-08	c		
				3.0E+00	I					1	0.1		Ethylphthalyl Ethyl Glycolate	84-72-0	1.9E+04	n	2.5E+05	nm					5.8E+03	n		1.3E+01	n		
				2.5E-04	I					1	0.1		Fenamiphos	22224-92-6	1.6E+00	n	2.1E+01	n					4.4E-01	n		4.3E-04	n		
				2.5E-02	I					1	0.1		Fenpropathrin	39515-41-8	1.6E+02	n	2.1E+03	n					6.4E+00	n		2.9E-01	n		
				2.5E-02	I					1	0.1		Fenvalerate	51630-58-1	1.6E+02	n	2.1E+03	n					5.0E+01	n		2.9E-01	n		
				1.3E-02	I					1	0.1		Fluometuron	2164-17-2	8.2E+01	n	1.1E+03	n					2.4E+01	n		1.9E-02	n		
				4.0E-02	C	1.3E-02	C			1			Fluoride	16984-48-8	3.1E+02	n	4.7E+03	n	1.4E+00	n	5.7E+00	n	8.0E+01	n		1.2E+01	n		
				6.0E-02	I	1.3E-02	C			1			Fluorine (Soluble Fluoride)	7782-41-4	4.7E+02	n	7.0E+03	n	1.4E+00	n	5.7E+00	n	1.2E+02	n	4.0E+03	1.8E+01	n	6.0E+02	
				8.0E-02	I					1	0.1		Fluridone	59756-60-4	5.1E+02	n	6.6E+03	n					1.4E+02	n		1.6E+01	n		
				2.0E-02	I					1	0.1		Flurprimidol	56425-91-3	1.3E+02	n	1.6E+03	n					3.4E+01	n		1.6E-01	n		
				7.0E-04	I					1	0.1		Flusilazole	85509-19-9	4.4E+00	n	5.7E+01	n					1.1E+00	n		1.8E-01	n		
				6.0E-02	I					1	0.1		Flutolanil	66332-96-5	3.8E+02	n	4.9E+03	n					9.5E+01	n		5.0E-01	n		
				1.0E-02	I					1	0.1		Fluvalinate	69409-94-5	6.3E+01	n	8.2E+02	n					2.0E+01	n		2.9E+01	n		
3.5E-03	I			1.0E-01	I					1	0.1		Folpet	133-07-3	1.6E+02	c**	6.6E+02	c*					2.0E+01	c**		4.7E-03	c**		
1.9E-01	I									1	0.1		Fomesafen	72178-02-0	2.9E+00	c	1.2E+01	c					3.9E-01	c		1.3E-03	c		
				2.0E-03	I					1	0.1		Fonofos	944-22-9	1.3E+01	n	1.6E+02	n					2.4E+00	n		4.7E-03	n		
		1.3E-05	I	2.0E-01	I	9.8E-03	A	V		1		4.2E+04	Formaldehyde	50-00-0	1.7E+01	c**	7.3E+01	c**	2.2E-01	c**	9.4E-01	c**	4.3E-01	c**		8.7E-05	c**		
				9.0E-01	P	3.0E-04	X	V		1		1.1E+05	Formic Acid	64-18-6	2.9E+00	n	1.2E+01	n	3.1E-02	n	1.3E-01	n	6.3E-02	n		1.3E-05	n		
				3.0E+00	I					1	0.1		Fosetyl-AL	39148-24-8	1.9E+04	n	2.5E+05	nm					6.0E+03	n		7.9E+01	n		
													Furans																	
				1.0E-03	X			V		1	0.03		~Dibenzofuran	132-64-9	7.3E+00	n	1.0E+02	n					7.9E-01	n		1.5E-02	n		
				1.0E-03	I			V		1	0.03	6.2E+03	~Furan	110-00-9	7.3E+00	n	1.0E+02	n					1.9E+00	n		7.3E-04	n		
				9.0E-01	I	2.0E+00	I	V		1	0.03	1.7E+05	~Tetrahydrofuran	109-99-9	1.8E+03	n	9.4E+03	n	2.1E+02	n	8.8E+02	n	3.4E+02	n		7.5E-02	n		
3.8E+00	H									1	0.1		Furazolidone	67-45-8	1.4E-01	c	6.0E-01	c					2.0E-02	c		3.9E-05	c		
				3.0E-03	I	5.0E-02	H	V		1		1.0E+04	Furfural	98-01-1	2.1E+01	n	2.6E+02	n	5.2E+00	n	2.2E+01	n	3.8E+00	n		8.1E-04	n		
1.5E+00	C	4.3E-04	C							1	0.1		Furium	531-82-8	3.6E-01	c	1.5E+00	c	6.5E-03	c	2.9E-02	c	5.1E-02	c		6.8E-05	c		
3.0E-02	I	8.6E-06	C							1	0.1		Furmecyclox	60568-05-0	1.8E+01	c	7.7E+01	c	3.3E-01	c	1.4E+00	c	1.1E+00	c		1.2E-03	c		
				4.0E-04	I					1	0.1		Glufosinate, Ammonium	77182-82-2	2.5E+00	n	3.3E+01	n					8.0E-01	n		1.8E-04	n		
						8.0E-05	C			1	0.1		Glutaraldehyde	111-30-8	1.1E+04	n	4.8E+04	n	8.3E-03	n	3.5E-02	n							
				4.0E-04	I	1.0E-03	H	V		1		1.1E+05	Glycidyl	765-34-4	2.3E+00	n	2.1E+01	n	1.0E-01	n	4.4E-01	n	1.7E-01	n		3.3E-05	n		
				1.0E-01	I					1	0.1		Glyphosate	1071-83-6	6.3E+02	n	8.2E+03	n					2.0E+02	n	7.0E+02	8.8E-01	n	3.1E+00	
				1.0E-02	X			V		1			Guanidine	113-00-8	7.8E+01	n	1.2E+03	n					2.0E+01	n		4.5E-03	n		
				2.0E-02	P					1	0.1		Guanidine Chloride	50-01-1	1.3E+02	n	1.6E+03	n					4.0E+01	n			n		
				5.0E-05	I					1	0.1		Haloxyfop, Methyl	69806-40-2	3.2E-01	n	4.1E+00	n					7.6E-02	n		8.4E-04	n		
4.5E+00	I	1.3E-03	I	5.0E-04	I			V		1			Heptachlor	76-44-8	1.3E-01	c*	6.3E-01	c*	2.2E-03	c	9.4E-03	c	1.4E-03	c*	4.0E-01	1.2E-04	c*	3.3E-02	
9.1E+00	I	2.6E-03	I	1.3E-05	I			V		1			Heptachlor Epoxide	1024-57-3	7.0E-02	c**	3.3E-01	c**	1.1E-03	c	4.7E-03	c	1.4E-03	c**	2.0E-01	2.8E-05	c**	4.1E-03	
				2.0E-03	I			V		1			Hexabromobenzene	87-82-1	1.6E+01	n	2.3E+02	n					4.0E+00	n		2.3E-02	n		
				2.0E-04	I					1	0.1		Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2	1.3E+00	n	1.6E+01	n					4.0E-01	n			n		
1.6E+00	I	4.6E-04	I	8.0E-04	I			V		1			Hexachlorobenzene	118-74-1	2.1E-01	c*	9.6E-01	c*	6.1E-03	c	2.7E-02	c	9.8E-03	c	1.0E+00	1.2E-04	c	1.3E-02	
7.8E-02	I	2.2E-05	I	1.0E-03	P			V		1		1.7E+01	Hexachlorobutadiene	87-68-3	1.2E+00	c**	5.3E+00	c*	1.3E-01	c	5.6E-01	c	1.4E-01	c**		2.7E-04	c**		
6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		Hexachlorocyclohexane, Alpha-	319-84-6	8.6E-02	c	3.6E-01	c	1.6E-03	c	6.8E-03	c	7.2E-03	c		4.2E-05	c		
1.8E+00	I	5.3E-04	I							1	0.1		Hexachlorocyclohexane, Beta-	319-85-7	3.0E-01	c	1.3E+00	c	5.3E-03	c	2.3E-02	c	2.5E-02	c		1.5E-04	c		
1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.04		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	5.7E-01	c**	2.5E+00	c*	9.1E-03	c	4.0E-02	c	4.2E-02	c**	2.0E-01	2.4E-04	c**	1.2E-03	
1.8E+00	I	5.1E-04	I							1	0.1		Hexachlorocyclohexane, Technical	608-73-1	3.0E-01	c	1.3E+00	c	5.5E-03	c	2.4E-02	c	2.5E-02	c		1.5E-04	c		
				6.0E-03	I	2.0E-04	I	V		1		1.6E+01	Hexachlorocyclopentadiene	77-47-4	1.8E-01	n	7.5E-01	n	2.1E-02	n	8.8E-02	n	4.1E-02	n	5.0E+01	1.3E-04	n	1.6E-01	
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I	V		1			Hexachloroethane	67-72-1	1.8E+00	c**	8.0E+00	c**	2.6E-01	c*	1.1E+00	c*	3.3E-01	c**		2.0E-04	c**		
				3.0E-04	I					1	0.1		Hexachlorophene	70-30-4	1.9E+00	n	2.5E+01	n					6.0E-01	n		8.0E-01	n		
1.1E-01	I			3.0E-03	I					1	0.015		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	6.1E+00	c**	2.8E+01	c*					7.0E-01	c**		2.7E-04	c**		
						1.0E-05	I	V		1		3.4E+03	Hexamethylene Diisocyanate, 1,6-	822-06-0	3.1E-01	n	1.3E+00	n	1.0E-03	n	4.4E-03	n	2.1E-03	n		2.1E-05	n		
				4.0E-04	P					1	0.1		Hexamethylphosphoramide	680-31-9	2.5E+00	n	3.3E+01	n					8.0E-01	n		1.8E-04	n		
						7.0E-01	I	V		1		1.4E+02	Hexane, N-	110-54-3	6.1E+01	n	2.5E+02	ns	7.3E+01	n	3.1E+02	n	1.5E+02	n		1.0E+00	n		
				2.0E+00	P					1	0.1		Hexanedioic Acid	124-04-9	1.3E+04	n	1.6E+05	nm					4.0E+03	n		9.9E-01	n		
				5.0E-03	I	3.0E-02	I	V		1		3.3E+03	Hexanone, 2-	591-78-6	2.0E+01	n	1.3E+02	n	3.1E+00	n	1.3E+01	n	3.8E+00	n		8.8E-04	n		
				3.3E-02	I					1	0.1		Hexazinone	51235-04-2	2.1E+02	n	2.7E+03	n					6.4E+01	n		3.0E-02	n		
				2.5E-02	I					1	0.1		Hexythiazox	78587-05-0	1.6E+02	n	2.1E+03	n					1.1E+01	n		5.0E-02	n		
				3.0E-04	I					1	0.1		Hydramethylnon	67485-29-4	1.9E+00	n	2.5E+01	n					5.9E-01	n		2.1E+02	n		
3.0E+00	I	4.9E-03	I			3.0E-05	P	V		1			Hydrazine	302-01-2	2.3E-01	c	1.1E+00	c	5.7E-04	c**	2.5E-03	c**	1.1E-03	c**			c**		
3.0E+00	I	4.9E-03	I							1			Hydrazine Sulfate	10034-93-2	2.3E-01	c	1.1E+00	c	5.7E-04	c	2.5E-03	c	2.6E-02	c			c		
						2.0E-02	I	V		1			Hydrogen Chloride	7647-01-0	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n	4.2E+00	n			n		
				4.0E-02	C	1.4E-02	C	V		1			Hydrogen Fluoride	7664-39-3	3.1E+02	n	4.7E+03	n	1.5E+00	n	6.1E+00	n	2.8E+00	n			n		
						2.0E-03	I	V		1			Hydrogen Sulfide	7783-06-4	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n	4.2E-01	n			n		

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
6.0E-02	P			4.0E-02	P					1	0.1		Hydroquinone	123-31-9	9.0E+00	c*	3.8E+01	c*					1.3E+00	c*		8.7E-04	c*	
				1.3E-02	I					1	0.1		Imazalil	35554-44-0	8.2E+01	n	1.1E+03	n					1.9E+01	n		3.2E-01	n	
				2.5E-01	I					1	0.1		Imazaquin	81335-37-7	1.6E+03	n	2.1E+04	n					4.9E+02	n		2.4E+00	n	
				2.5E-01	I					1	0.1		Imazethapyr	81335-77-5	1.6E+03	n	2.1E+04	n					4.7E+02	n		4.1E-01	n	
				1.0E-02	A					1			Iodine	7553-56-2	7.8E+01	n	1.2E+03	n					2.0E+01	n		1.2E+00	n	
				4.0E-02	I					1	0.1		Iprodione	36734-19-7	2.5E+02	n	3.3E+03	n					7.4E+01	n		2.2E-02	n	
				7.0E-01	P					1			Iron	7439-89-6	5.5E+03	n	8.2E+04	n					1.4E+03	n		3.5E+01	n	
				3.0E-01	I			V		1		1.0E+04	Isobutyl Alcohol	78-83-1	2.3E+03	n	3.5E+04	ns					5.9E+02	n		1.2E-01	n	
9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		Isophorone	78-59-1	5.7E+02	c**	2.4E+03	c**	2.1E+02	n	8.8E+02	n	7.8E+01	c**		2.6E-02	c**	
				1.5E-02	I			V		1			Isopropalin	33820-53-0	1.2E+02	n	1.8E+03	n					4.0E+00	n		9.2E-02	n	
				2.0E+00	P	2.0E-01	P	V		1		1.1E+05	Isopropanol	67-63-0	5.6E+02	n	2.4E+03	n	2.1E+01	n	8.8E+01	n	4.1E+01	n		8.4E-03	n	
				1.0E-01	I					1	0.1		Isopropyl Methyl Phosphonic Acid	1832-54-8	6.3E+02	n	8.2E+03	n					2.0E+02	n		4.3E-02	n	
				5.0E-02	I					1	0.1		Isoxaben	82558-50-7	3.2E+02	n	4.1E+03	n					7.3E+01	n		2.0E-01	n	
						3.0E-01	A	V		1			JP-7	NA	4.3E+07	nm	1.8E+08	nm	3.1E+01	n	1.3E+02	n	6.3E+01	n			n	
				2.0E-03	I					1	0.1		Lactofen	77501-63-4	1.3E+01	n	1.6E+02	n					2.5E+00	n		1.2E-01	n	
													Lead Compounds																
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			~Lead Chromate	7758-97-6	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
8.5E-03	C	1.2E-05	C							1			~Lead Phosphate	7446-27-7	8.2E+01	c	3.8E+02	c	2.3E-01	c	1.0E+00	c	9.1E+00	c			c	
8.5E-03	C	1.2E-05	C							1	0.1		~Lead acetate	301-04-2	6.4E+01	c	2.7E+02	c	2.3E-01	c	1.0E+00	c	9.2E+00	c		1.8E-03	c	
										1			~Lead and Compounds	7439-92-1	4.0E+02	L	8.0E+02	L	1.5E-01	L			1.5E+01	L	1.5E+01		L	1.4E+01
8.5E-03	C	1.2E-05	C							1	0.1		~Lead subacetate	1335-32-6	6.4E+01	c	2.7E+02	c	2.3E-01	c	1.0E+00	c	9.2E+00	c		2.0E-03	c	
				1.0E-07	I			V		1		2.4E+00	~Tetraethyl Lead	78-00-2	7.8E-04	n	1.2E-02	n					1.3E-04	n		4.7E-07	n	
				5.0E-06	P			V		1		3.8E+02	Lewisite	541-25-3	3.9E-02	n	5.8E-01	n					9.0E-03	n		3.8E-06	n	
				2.0E-03	I					1	0.1		Linuron	330-55-2	1.3E+01	n	1.6E+02	n					3.3E+00	n		2.9E-03	n	
				2.0E-03	P					1			Lithium	7439-93-2	1.6E+01	n	2.3E+02	n					4.0E+00	n		1.2E+00	n	
				5.0E-04	I					1	0.1		MCPA	94-74-6	3.2E+00	n	4.1E+01	n					7.5E-01	n		2.0E-04	n	
				1.0E-02	I					1	0.1		MCPB	94-81-5	6.3E+01	n	8.2E+02	n					1.5E+01	n		5.8E-03	n	
				1.0E-03	I					1	0.1		MCPP	93-65-2	6.3E+00	n	8.2E+01	n					1.6E+00	n		4.7E-04	n	
				2.0E-02	I					1	0.1		Malathion	121-75-5	1.3E+02	n	1.6E+03	n					3.9E+01	n		1.0E-02	n	
				1.0E-01	I	7.0E-04	C			1	0.1		Maleic Anhydride	108-31-6	6.3E+02	n	8.0E+03	n	7.3E-02	n	3.1E-01	n	1.9E+02	n		3.8E-02	n	
				5.0E-01	I					1	0.1		Maleic Hydrazide	123-33-1	3.2E+03	n	4.1E+04	n					1.0E+03	n		2.1E-01	n	
				1.0E-04	P					1	0.1		Malononitrile	109-77-3	6.3E-01	n	8.2E+00	n					2.0E-01	n		4.1E-05	n	
				3.0E-02	H					1	0.1		Mancozeb	8018-01-7	1.9E+02	n	2.5E+03	n					5.4E+01	n		7.6E-02	n	
				5.0E-03	I					1	0.1		Maneb	12427-38-2	3.2E+01	n	4.1E+02	n					9.8E+00	n		1.4E-02	n	
				1.4E-01	I	5.0E-05	I			1			Manganese (Diet)	7439-96-5														
				2.4E-02	S	5.0E-05	I			0.04			Manganese (Non-diet)	7439-96-5	1.8E+02	n	2.6E+03	n	5.2E-03	n	2.2E-02	n	4.3E+01	n		2.8E+00	n	
				9.0E-05	H					1	0.1		Mephosfolan	950-10-7	5.7E-01	n	7.4E+00	n					1.8E-01	n		2.6E-04	n	
				3.0E-02	I					1	0.1		Mepiquat Chloride	24307-26-4	1.9E+02	n	2.5E+03	n					6.0E+01	n		2.0E-02	n	
													Mercury Compounds																
				3.0E-04	I	3.0E-04	S			0.07			~Mercuric Chloride (and other Mercury salts)	7487-94-7	2.3E+00	n	3.5E+01	n	3.1E-02	n	1.3E-01	n	5.7E-01	n	2.0E+00		n	
						3.0E-04	I	V		1		3.1E+00	~Mercury (elemental)	7439-97-6	1.1E+00	n	4.6E+00	ns	3.1E-02	n	1.3E-01	n	6.3E-02	n	2.0E+00	3.3E-03	n	1.0E-01
				1.0E-04	I					1			~Methyl Mercury	22967-92-6	7.8E-01	n	1.2E+01	n					2.0E-01	n			n	
				8.0E-05	I					1	0.1		~Phenylmercuric Acetate	62-38-4	5.1E-01	n	6.6E+00	n					1.6E-01	n		5.0E-05	n	
				3.0E-05	I			V		1			Merphos	150-50-5	2.3E-01	n	3.5E+00	n					6.0E-02	n		5.9E-03	n	
				3.0E-05	I					1	0.1		Merphos Oxide	78-48-8	1.9E-01	n	2.5E+00	n					8.5E-03	n		4.2E-05	n	
				6.0E-02	I					1	0.1		Metalaxyl	57837-19-1	3.8E+02	n	4.9E+03	n					1.2E+02	n		3.3E-02	n	
				1.0E-04	I	3.0E-02	P	V		1		4.6E+03	Methacrylonitrile	126-98-7	7.5E-01	n	1.0E+01	n	3.1E+00	n	1.3E+01	n	1.9E-01	n		4.3E-05	n	
				5.0E-05	I					1	0.1		Methamidophos	10265-92-6	3.2E-01	n	4.1E+00	n					1.0E-01	n		2.1E-05	n	
				2.0E+00	I	2.0E+01	I	V		1		1.1E+05	Methanol	67-56-1	1.2E+04	n	1.2E+05	nms	2.1E+03	n	8.8E+03	n	2.0E+03	n		4.1E-01	n	
				1.0E-03	I					1	0.1		Methidathion	950-37-8	6.3E+00	n	8.2E+01	n					1.9E+00	n		4.7E-04	n	
				2.5E-02	I					1	0.1		Methomyl	16752-77-5	1.6E+02	n	2.1E+03	n					5.0E+01	n		1.1E-02	n	
4.9E-02	C	1.4E-05	C							1	0.1		Methoxy-5-nitroaniline, 2-	99-59-2	1.1E+01	c	4.7E+01	c	2.0E-01	c	8.8E-01	c	1.5E+00	c		5.3E-04	c	
				5.0E-03	I					1	0.1		Methoxychlor	72-43-5	3.2E+01	n	4.1E+02	n					3.7E+00	n	4.0E+01	2.0E-01	n	2.2E+00
				8.0E-03	P	1.0E-03	P	V		1		1.2E+05	Methoxyethanol Acetate, 2-	110-49-6	1.1E+01	n	5.1E+01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		4.2E-05	n	
				5.0E-03	P	2.0E-02	I	V		1		1.1E+05	Methoxyethanol, 2-	109-86-4	3.3E+01	n	3.5E+02	n	2.1E+00	n	8.8E+00	n	2.9E+00	n		5.9E-04	n	
				1.0E+00	X			V		1		2.9E+04	Methyl Acetate	79-20-9	7.8E+03	n	1.2E+05	nms					2.0E+03	n		4.1E-01	n	
						2.0E-02	P	V		1		6.8E+03	Methyl Acrylate	96-33-3	1.5E+01	n	6.1E+01	n	2.1E+00	n	8.8E+00	n	4.2E+00	n		8.9E-04	n	
				6.0E-01	I	5.0E+00	I	V		1		2.8E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3	2.7E+03	n	1.9E+04	n	5.2E+02	n	2.2E+03	n	5.6E+02	n		1.2E-01	n	
		1.0E-03	X	1.0E-03	P	2.0E-05	X	V		1		1.8E+05	Methyl Hydrazine	60-34-4	1.0E-01	n	4.4E-01	n	2.1E-03	n	8.8E-03	n	4.2E-03	n		9.4E-07	n	
						3.0E+00	I	V		1		3.4E+03	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	3.3E+03	n	1.4E+04	ns	3.1E+02	n	1.3E+03	n	6.3E+02	n		1.4E-01	n	
						1.0E-03	C	V		1		1.0E+04	Methyl Isocyanate	624-83-9	4.6E-01	n	1.9E+00	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		5.9E-05	n	
				1.4E+00	I	7.0E-01	I	V		1		2.4E+03	Methyl Methacrylate	80-62-6	4.4E+02	n	1.9E+03	n	7.3E+01	n	3.1E+02	n	1.4E+02	n		3.0E-02	n	
				2.5E-04	I					1	0.1		Methyl Parathion	298-00-0	1.6E+00	n	2.1E+01	n					4.5E-01	n		7.4E-04	n	
				6.0E-02	X					1	0.1		Methyl Phosphonic Acid	993-13-5	3.8E+02	n	4.9E+03	n					1.2E+02	n		2.4E-02	n	
				6.0E-03	H	4.0E-02	H	V		1		3.9E+02	Methyl Styrene (Mixed Isomers)	25013-15-4	3.2E+01	n	2.6E+02	n	4.2E+00	n	1.8E+01	n	2.3E+00	n		3.8E-03	n	
9.9E-02	C	2.8E-05	C							1	0.1		Methyl methanesulfonate	66-27-3	5.5E+00	c	2.3E+01	c	1.0E-01	c	4.4E-01	c	7.9E-01	c		1.6E-04	c	
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	4.7E+01	c*	2.1E+02	c*	1.1E+01	c*	4.7E+01	c*	1.4E+01	c*		3.2E-03	c*	
				3.0E-04	X					1	0.1		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	1.9E+00	n	2.5E+01	n					6.0E-01	n		3.6E-04	n	
9.0E-03	P			2.0E-02	X					1	0.1		Methyl-5-Nitroaniline, 2-	99-55-8	6.0E+01	c**	2.6E+02	c**					8.2E+00	c**		4.6E-03	c**	
8.3E+00	C	2.4E-03	C							1	0.1		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	6.5E-02	c	2.8E-01	c	1.2E-03	c	5.1E-03	c	9.4E-03	c		3.2E-06	c	
1.3E-01	C	3.7E-05	C							1	0.1		Methylaniline Hydrochloride, 2-	636-21-5	4.2E+00	c	1.8E+01	c	7.6E-02	c	3.3E-01	c	6.0E-01	c		2.6E-04	c	
				1.0E-02	A					1	0.1		Methylarsonic acid	124-58-3	6.3E+01	n	8.2E+02	n					2.0E+01	n		5.8E-03	n	
				2.0E-04	X					1	0.1		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	1.3E+00	n	1.6E+01	n					4.0E-01	n			n	
1.0E-01	X			3.0E-04	X					1	0.1		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	1.9E+00	n	2.3E+01	c**					6.0E-01	n			n	
2.2E+01	C	6.3E-03	C						M	1	0.1		Methylcholanthrene, 3-	56-49-5	5.5E-03	c	1.0E-01	c	1.6E-04	c	1.9E-03	c	1.1E-03	c		2.2E-03	c	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	1		3.3E+03	Methylene Chloride	75-09-2	3.5E+01	n	3.2E+02	n	6.3E+01	n	2.6E+02	n	1.1E+01	n	5.0E+00	2.7E-03	n	1.3E-03
1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.2E+00	c*	2.3E+01	c**	2.4E-03	c	2.9E-02	c	1.6E-01	c*		1.8E-03	c*		
4.6E-02	I	1.3E-05	C							1	0.1		Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	1.2E+01	c	5.0E+01	c	2.2E-01	c	9.4E-01	c	4.8E-01	c		2.6E-03	c		
1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		Methylenebisbenzenamine, 4,4'-	101-77-9	3.4E-01	c	1.4E+00	c	6.1E-03	c	2.7E-02	c	4.7E-02	c		2.1E-04	c		
						6.0E-04	I			1	0.1		Methylenediphenyl Diisocyanate	101-68-8	8.5E+04	n	3.6E+05	nm	6.3E-02	n	2.6E-01	n							
				7.0E-02	H			V		1		5.0E+02	Methylstyrene, Alpha-	98-83-9	5.5E+02	ns	8.2E+03	ns					7.8E+01	n		1.2E-01	n		
				1.5E-01	I					1	0.1		Metolachlor	51218-45-2	9.5E+02	n	1.2E+04	n					2.7E+02	n		3.2E-01	n		
				2.5E-02	I					1	0.1		Metribuzin	21087-64-9	1.6E+02	n	2.1E+03	n					4.9E+01	n		1.5E-02	n		
				2.5E-01	I					1	0.1		Metsulfuron-methyl	74223-64-6	1.6E+03	n	2.1E+04	n					4.9E+02	n		1.9E-01	n		
				3.0E+00	P			V		1		3.4E-01	Mineral oils	8012-95-1	2.3E+04	ns	3.5E+05	nms					6.0E+03	n		2.4E+02	n		
1.8E+01	C	5.1E-03	C	2.0E-04	I			V		1			Mirex	2385-85-5	3.6E-02	c*	1.7E-01	c	5.5E-04	c	2.4E-03	c	8.8E-04	c		6.3E-04	c		
				2.0E-03	I					1	0.1		Molinate	2212-67-1	1.3E+01	n	1.6E+02	n					3.0E+00	n		1.7E-03	n		
				5.0E-03	I					1			Molybdenum	7439-98-7	3.9E+01	n	5.8E+02	n					1.0E+01	n		2.0E-01	n		
				1.0E-01	I					1			Monochloramine	10599-90-3	7.8E+02	n	1.2E+04	n					2.0E+02	n	4.0E+03		n		
				2.0E-03	P					1	0.1		Monomethylaniline	100-61-8	1.3E+01	n	1.6E+02	n					3.8E+00	n		1.4E-03	n		
				2.5E-02	I					1	0.1		Myclobutanil	88671-89-0	1.6E+02	n	2.1E+03	n					4.5E+01	n		5.6E-01	n		
				3.0E-04	X					1	0.1		N,N'-Diphenyl-1,4-benzenediamine	74-31-7	1.9E+00	n	2.5E+01	n					3.6E-01	n		3.7E-02	n		
				2.0E-03	I			V		1			Naled	300-76-5	1.6E+01	n	2.3E+02	n					4.0E+00	n		1.8E-03	n		
				3.0E-02	X	1.0E-01	P	V		1			Naphtha, High Flash Aromatic (HFAN)	64742-95-6	2.3E+02	n	3.5E+03	n	1.0E+01	n	4.4E+01	n	1.5E+01	n			n		
1.8E+00	C	0.0E+00	C							1	0.1		Naphthylamine, 2-	91-59-8	3.0E-01	c	1.3E+00	c					3.9E-02	c		2.0E-04	c		
				1.0E-01	I					1	0.1		Napropamide	15299-99-7	6.3E+02	n	8.2E+03	n					1.6E+02	n		1.1E+00	n		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickel Acetate	373-02-4	6.7E+01	n	8.1E+02	n	1.5E-03	n	6.1E-03	n	2.2E+01	n		4.5E-03	n		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickel Carbonate	3333-67-3	6.7E+01	n	8.1E+02	n	1.5E-03	n	6.1E-03	n	2.2E+01	n			n		
		2.6E-04	C	1.1E-02	C	1.4E-05	C	V		1			Nickel Carbonyl	13463-39-3	8.2E+01	n	1.1E+03	n	1.5E-03	n	6.1E-03	n	2.9E-03	n			n		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			0.04			Nickel Hydroxide	12054-48-7	8.2E+01	n	1.1E+03	n	1.5E-03	n	6.1E-03	n	2.0E+01	n			n		
		2.6E-04	C	1.1E-02	C	2.0E-05	C			0.04			Nickel Oxide	1313-99-1	8.4E+01	n	1.2E+03	n	2.1E-03	n	8.8E-03	n	2.0E+01	n			n		
		2.4E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Refinery Dust	NA	8.2E+01	n	1.1E+03	n	1.5E-03	n	6.1E-03	n	2.2E+01	n		3.2E+00	n		
		2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			Nickel Soluble Salts	7440-02-0	1.5E+02	n	2.2E+03	n	9.4E-03	n	3.9E-02	n	3.9E+01	n		2.6E+00	n		
1.7E+00	C	4.8E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Subsulfide	12035-72-2	4.1E-01	c	1.9E+00	c	1.5E-03	n	6.1E-03	n	4.5E-02	c			c		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickelocene	1271-28-9	6.7E+01	n	8.1E+02	n	1.5E-03	n	6.1E-03	n	2.2E+01	n			n		
				1.6E+00	I					1			Nitrate	14797-55-8	1.3E+04	n	1.9E+05	nm					3.2E+03	n	1.0E+04		n		
										1			Nitrate + Nitrite (as N)	NA											1.0E+04				
				1.0E-01	I					1			Nitrite	14797-65-0	7.8E+02	n	1.2E+04	n					2.0E+02	n	1.0E+03		n		
				1.0E-02	X	5.0E-05	X			1	0.1		Nitroaniline, 2-	88-74-4	6.3E+01	n	8.0E+02	n	5.2E-03	n	2.2E-02	n	1.9E+01	n		8.0E-03	n		
2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		Nitroaniline, 4-	100-01-6	2.5E+01	n	1.1E+02	c**	6.3E-01	n	2.6E+00	n	3.8E+00	c**		1.6E-03	c**		
		4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	Nitrobenzene	98-95-3	5.1E+00	c**	2.2E+01	c**	7.0E-02	c*	3.1E-01	c*	1.4E-01	c**		9.2E-05	c**		
				3.0E+03	P					1	0.1		Nitrocellulose	9004-70-0	1.9E+07	nm	2.5E+08	nm					6.0E+06	n		1.3E+03	n		
				7.0E-02	H					1	0.1		Nitrofurantoin	67 20 9	4.4E+02	n	5.7E+03	n					1.4E+02	n		6.1E-02	n		
1.3E+00	C	3.7E-04	C							1	0.1		Nitrofurazone	59-87-0	4.2E-01	c	1.8E+00	c	7.6E-03	c	3.3E-02	c	6.0E-02	c		5.4E-05	c		
1.7E-02	P			1.0E-04	P					1	0.1		Nitroglycerin	55-63-0	6.3E-01	n	8.2E+00	n					2.0E-01	n		8.5E-05	n		
				1.0E-01	I					1	0.1		Nitroguanidine	556-88-7	6.3E+02	n	8.2E+03	n					2.0E+02	n		4.8E-02	n		
		8.8E-06	P			5.0E-03	P	V		1		1.8E+04	Nitromethane	75-52-5	5.4E+00	c**	2.4E+01	c**	3.2E-01	c**	1.4E+00	c**	6.4E-01	c**		1.4E-04	c**		
		2.7E-03	H			2.0E-02	I	V		1		4.9E+03	Nitropropane, 2-	79-46-9	1.4E-02	c	6.0E-02	c	1.0E-03	c	4.5E-03	c	2.1E-03	c		5.4E-07	c		
2.7E+01	C	7.7E-03	C						M	1	0.1		Nitroso-N-ethylurea, N-	759-73-9	4.5E-03	c	8.5E-02	c	1.3E-04	c	1.6E-03	c	9.2E-04	c		2.2E-07	c		
1.2E+02	C	3.4E-02	C						M	1	0.1		Nitroso-N-methylurea, N-	684-93-5	1.0E-03	c	1.9E-02	c	3.0E-05	c	3.6E-04	c	2.1E-04	c		4.6E-08	c		
5.4E+00	I	1.6E-03	I					V		1			Nitroso-di-N-butylamine, N-	924-16-3	9.9E-02	c	4.6E-01	c	1.8E-03	c	7.7E-03	c	2.7E-03	c		5.5E-06	c		
7.0E+00	I	2.0E-03	C							1	0.1		Nitroso-di-N-propylamine, N-	621-64-7	7.8E-02	c	3.3E-01	c	1.4E-03	c	6.1E-03	c	1.1E-02	c		8.1E-06	c		
2.8E+00	I	8.0E-04	C							1	0.1		Nitrosodiethanolamine, N-	1116-54-7	1.9E-01	c	8.2E-01	c	3.5E-03	c	1.5E-02	c	2.8E-02	c		5.6E-06	c		
1.5E+02	I	4.3E-02	I						M	1	0.1		Nitrosodiethylamine, N-	55-18-5	8.1E-04	c	1.5E-02	c	2.4E-05	c	2.9E-04	c	1.7E-04	c		6.1E-08	c		
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	V	M	1		2.4E+05	Nitrosodimethylamine, N-	62-75-9	2.0E-03	c*	3.4E-02	c*	7.2E-05	c*	8.8E-04	c*	1.1E-04	c*		2.7E-08	c*		
4.9E-03	I	2.6E-06	C							1	0.1		Nitrosodiphenylamine, N-	86-30-6	1.1E+02	c	4.7E+02	c	1.1E+00	c	4.7E+00	c	1.2E+01	c		6.7E-02	c		
2.2E+01	I	6.3E-03	C					V		1		1.1E+05	Nitrosomethylethylamine, N-	10595-95-6	2.0E-02	c	9.1E-02	c	4.5E-04	c	1.9E-03	c	7.1E-04	c		2.0E-07	c		
6.7E+00	C	1.9E-03	C							1	0.1		Nitrosomorpholine [N-]	59-89-2	8.1E-02	c	3.4E-01	c	1.5E-03	c	6.5E-03	c	1.2E-02	c		2.8E-06	c		
9.4E+00	C	2.7E-03	C							1	0.1		Nitrosopiperidine [N-]	100-75-4	5.8E-02	c	2.4E-01	c	1.0E-03	c	4.5E-03	c	8.2E-03	c		4.4E-06	c		
2.1E+00	I	6.1E-04	I							1	0.1		Nitrosopyrrolidine, N-	930-55-2	2.6E-01	c	1.1E+00	c	4.6E-03	c	2.0E-02	c	3.7E-02	c		1.4E-05	c		
				1.0E-04	X					1	0.1		Nitrotoluene, m-	99-08-1	6.3E-01	n	8.2E+00	n					1.7E-01	n		1.6E-04	n		
2.2E-01	P			9.0E-04	P			V		1		1.5E+03	Nitrotoluene, o-	88-72-2	3.2E+00	c**	1.5E+01	c**					3.1E-01	c**		3.0E-04	c**		
1.6E-02	P			4.0E-03	P					1	0.1		Nitrotoluene, p-	99-99-0	2.5E+01	n	1.4E+02	c**					4.3E+00	c**		4.0E-03	c**		
				3.0E-04	X	2.0E-02	P	V		1		6.9E+00	Nonane, n-	111-84-2	1.1E+00	n	7.2E+00	ns	2.1E+00	n	8.8E+00	n	5.3E-01	n		7.5E-03	n		
				4.0E-02	I					1	0.1		Norflurazon	27314-13-2	2.5E+02	n	3.3E+03	n					7.7E+01	n		5.0E-01	n		
				3.0E-03	I					1	0.1		Octabromodiphenyl Ether	32536-52-0	1.9E+01	n	2.5E+02	n					6.0E+00	n		1.2E+00	n		
				5.0E-02	I					1	0.006		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	3.9E+02	n	5.7E+03	n					1.0E+02	n		1.3E-01	n		
				2.0E-03	H					1	0.1		Octamethylpyrophosphoramide	152-16-9	1.3E+01	n	1.6E+02	n					4.0E+00	n		9.6E-04	n		
				5.0E-02	I					1	0.1		Oryzalin	19044-88-3	3.2E+02	n	4.1E+03	n					8.1E+01	n		1.5E-01	n		
				5.0E-03	I					1	0.1		Oxadiazon	19666-30-9	3.2E+01	n	4.1E+02	n					4.7E+00	n		4.8E-02	n		
				2.5E-02	I					1	0.1		Oxamyl	23135-22-0	1.6E+02	n	2.1E+03	n					5.0E+01	n	2.0E+02	1.1E-02	n	4.4E-02	
				3.0E-03	I					1	0.1		Oxyfluorfen	42874-03-3	1.9E+01	n	2.5E+02	n					3.2E+00	n		2.5E-01	n		
				1.3E-02	I					1	0.1		Paclobutrazol	76738-62-0	8.2E+01	n	1.1E+03	n					2.3E+01	n		4.6E-02	n		
				4.5E-03	I					1	0.1		Paraquat Dichloride	1910-42-5	2.8E+01	n	3.7E+02	n					9.0E+00	n		1.2E-01	n		
				6.0E-03	H					1	0.1		Parathion	56-38-2	3.8E+01	n	4.9E+02	n					8.6E+00	n		4.3E-02	n		
				5.0E-02	H			V		1			Pebulate	1114-71-2	3.9E+02	n	5.8E+03	n					5.6E+01	n		4.5E-02	n		
				4.0E-02	I					1	0.1		Pendimethalin	40487-42-1	2.5E+02	n	3.3E+03	n					1.8E+01	n		2.1E-01	n		
				2.0E-03	I			V		1		3.1E-01	Pentabromodiphenyl Ether	32534-81-9	1.6E+01	ns	2.3E+02	ns					4.0E+00	n		1.7E-01	n		
				1.0E-04	I					1	0.1		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9	6.3E-01	n	8.2E+00	n					2.0E-01	n		8.7E-03	n		
				8.0E-04	I			V		1			Pentachlorobenzene	608-93-5	6.3E+00	n	9.3E+01	n					3.2E-01	n		2.4E-03	n		

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
9.0E-02	P							V		1		4.6E+02	Pentachloroethane	76-01-7	7.7E+00	c	3.6E+01	c					6.5E-01	c		3.1E-04	c	
2.6E-01	H			3.0E-03	I			V		1			Pentachloronitrobenzene	82-68-8	2.7E+00	c**	1.3E+01	c*					1.2E-01	c*		1.5E-03	c*	
4.0E-01	I	5.1E-06	C	5.0E-03	I					1	0.25		Pentachlorophenol	87-86-5	1.0E+00	c*	4.0E+00	c*	5.5E-01	c	2.4E+00	c	4.1E-02	c*	1.0E+00	5.7E-05	c*	1.4E-03
4.0E-03	X			2.0E-03	P					1	0.1		Pentaerythritol tetranitrate (PETN)	78-11-5	1.3E+01	n	1.6E+02	n					3.9E+00	n		5.8E-03	n	
						1.0E+00	P	V		1		3.9E+02	Pentane, n-	109-66-0	8.1E+01	n	3.4E+02	n	1.0E+02	n	4.4E+02	n	2.1E+02	n		1.0E+00	n	
													Perchlorates																
				7.0E-04	I					1			~Ammonium Perchlorate	7790-98-9	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				7.0E-04	I					1			~Lithium Perchlorate	7791-03-9	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				7.0E-04	I					1			~Perchlorate and Perchlorate Salts	14797-73-0	5.5E+00	n	8.2E+01	n					1.4E+00	n	1.5E+01(F)		n	
				7.0E-04	I					1			~Potassium Perchlorate	7778-74-7	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				7.0E-04	I					1			~Sodium Perchlorate	7601-89-0	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				2.0E-02	P			V		1			Perfluorobutane Sulfonate	375-73-5	1.6E+02	n	2.3E+03	n					3.8E+01	n		2.1E-02	n	
				5.0E-02	I					1	0.1		Permethrin	52645-53-1	3.2E+02	n	4.1E+03	n					1.0E+02	n		2.4E+01	n	
2.2E-03	C	6.3E-07	C							1	0.1		Phenacetin	62-44-2	2.5E+02	c	1.0E+03	c	4.5E+00	c	1.9E+01	c	3.4E+01	c		9.7E-03	c	
				2.5E-01	I					1	0.1		Phenmedipham	13684-63-4	1.6E+03	n	2.1E+04	n					4.0E+02	n		2.1E+00	n	
				3.0E-01	I	2.0E-01	C			1	0.1		Phenol	108-95-2	1.9E+03	n	2.5E+04	n	2.1E+01	n	8.8E+01	n	5.8E+02	n		3.3E-01	n	
				4.0E-03	I					1	0.1		Phenol, 2-(1-methylethoxy)-, methylcarbamate	114-26-1	2.5E+01	n	3.3E+02	n					7.8E+00	n		2.5E-03	n	
				5.0E-04	X					1	0.1		Phenothiazine	92-84-2	3.2E+00	n	4.1E+01	n					4.3E-01	n		1.4E-03	n	
				6.0E-03	I					1	0.1		Phenylenediamine, m-	108-45-2	3.8E+01	n	4.9E+02	n					1.2E+01	n		3.2E-03	n	
4.7E-02	H									1	0.1		Phenylenediamine, o-	95-54-5	1.2E+01	c	4.9E+01	c					1.6E+00	c		4.4E-04	c	
				1.9E-01	H					1	0.1		Phenylenediamine, p-	106-50-3	1.2E+03	n	1.6E+04	n					3.8E+02	n		1.0E-01	n	
1.9E-03	H									1	0.1		Phenylphenol, 2-	90-43-7	2.8E+02	c	1.2E+03	c					3.0E+01	c		4.1E-01	c	
				2.0E-04	H					1	0.1		Phorate	298-02-2	1.3E+00	n	1.6E+01	n					3.0E-01	n		3.4E-04	n	
						3.0E-04	I	V		1		1.6E+03	Phosgene	75-44-5	3.1E-02	n	1.3E-01	n	3.1E-02	n	1.3E-01	n						
				2.0E-02	I					1	0.1		Phosmet	732-11-6	1.3E+02	n	1.6E+03	n					3.7E+01	n		8.2E-03	n	
													Phosphates, Inorganic																
				4.9E+01	P					1			~Aluminum metaphosphate	13776-88-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Ammonium polyphosphate	68333-79-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Calcium pyrophosphate	7790-76-3	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Diammonium phosphate	7783-28-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Dicalcium phosphate	7757-93-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Dimagnesium phosphate	7782-75-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Dipotassium phosphate	7758-11-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Disodium phosphate	7558-79-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monoaluminum phosphate	13530-50-2	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monoammonium phosphate	7722-76-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monocalcium phosphate	7758-23-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monomagnesium phosphate	7757-86-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monopotassium phosphate	7778-77-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monosodium phosphate	7558-80-7	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Polyphosphoric acid	8017-16-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Potassium tripolyphosphate	13845-36-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium acid pyrophosphate	7758-16-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium aluminum phosphate (acidic)	7785-88-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium aluminum phosphate (anhydrous)	10279-59-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium aluminum phosphate (tetrahydrate)	10305-76-7	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium hexametaphosphate	10124-56-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium polyphosphate	68915-31-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium trimetaphosphate	7785-84-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium tripolyphosphate	7758-29-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tetrapotassium phosphate	7320-34-5	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tetrasodium pyrophosphate	7722-88-5	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tricalcium phosphate	7758-87-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Trimagnesium phosphate	7757-87-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tripotassium phosphate	7778-53-2	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Trisodium phosphate	7601-54-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				3.0E-04	I	3.0E-04	I	V		1			Phosphine	7803-51-2	2.3E+00	n	3.5E+01	n	3.1E-02	n	1.3E-01	n	5.7E-02	n			n	
				4.9E+01	P	1.0E-02	I			1			Phosphoric Acid	7664-38-2	3.0E+05	nm	2.9E+06	nm	1.0E+00	n	4.4E+00	n	9.7E+04	n			n	
				2.0E-05	I			V		1			Phosphorus, White	7723-14-0	1.6E-01	n	2.3E+00	n					4.0E-02	n		1.5E-04	n	
													Phthalates																
1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		~Bis(2-ethylhexyl)phthalate	117-81-7	3.9E+01	c**	1.6E+02	c*	1.2E+00	c	5.1E+00	c	5.6E+00	c**	6.0E+00	1.3E+00	c**	1.4E+00
1.9E-03	P			2.0E-01	I					1	0.1		~Butyl Benzyl Phthalate	85-68-7	2.9E+02	c**	1.2E+03	c*					1.6E+01	c*		2.4E-01	c*	
				1.0E+00	I					1	0.1		~Butylphthalyl Butylglycolate	85-70-1	6.3E+03	n	8.2E+04	n					1.3E+03	n		3.1E+01	n	
				1.0E-01	I					1	0.1		~Dibutyl Phthalate	84-74-2	6.3E+02	n	8.2E+03	n					9.0E+01	n		2.3E-01	n	
				8.0E-01	I					1	0.1		~Diethyl Phthalate	84-66-2	5.1E+03	n	6.6E+04	n					1.5E+03	n		6.1E-01	n	
				1.0E-01	I			V		1			~Dimethylterephthalate	120-61-6	7.8E+02	n	1.2E+04	n					1.9E+02	n		4.9E-02	n	
				1.0E-02	P					1	0.1		~Octyl Phthalate, di-N-	117-84-0	6.3E+01	n	8.2E+02	n					2.0E+01	n		5.7E+00	n	
				1.0E+00	H					1	0.1		~Phthalic Acid, P-	100-21-0	6.3E+03	n	8.2E+04	n					1.9E+03	n		6.8E-01	n	
				2.0E+00	I	2.0E-02	C			1	0.1		~Phthalic Anhydride	85-44-9	1.3E+04	n	1.6E+05	nm	2.1E+00	n	8.8E+00	n	3.9E+03	n		8.5E-01	n	
				7.0E-02	I					1	0.1		Picloram	1918-02-1	4.4E+02	n	5.7E+03	n					1.4E+02	n	5.0E+02	3.8E-02	n	1.4E-01
				1.0E-04	X					1	0.1		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	6.3E-01	n	8.2E+00	n					2.0E-01	n		1.3E-04	n	
				9.0E-04	X					1	0.1		Picric Acid (2,4,6-Trinitrophenol)	88-89-1	5.7E+00	n	7.4E+01	n					1.8E+00	n		8.4E-03	n	
				1.0E-02	I					1	0.1		Pirimiphos, Methyl	29232-93-7	6.3E+01	n	8.2E+02	n					1.2E+01	n		1.2E-02	n	
3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		Polybrominated Biphenyls	59536-65-1	1.8E-02	c**	7.7E-02	c**	3.3E-04	c	1.4E-03	c	2.6E-03	c**			c**	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels													Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (μg/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (μg/m^3)	key	Industrial Air (μg/m^3)	key	Tapwater (μg/L)	key	MCL (μg/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
													Polychlorinated Biphenyls (PCBs)															
7.0E-02	S	2.0E-05	S	7.0E-05	I			V		1	0.14		~Aroclor 1016	12674-11-2	4.1E-01	n	5.1E+00	n	1.4E-01	c	6.1E-01	c	1.4E-01	n		1.3E-02	n	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1221	11104-28-2	2.0E-01	c	8.3E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1232	11141-16-5	1.7E-01	c	7.2E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1242	53469-21-9	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1248	12672-29-6	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.0E+00	S	5.7E-04	S	2.0E-05	I			V		1	0.14		~Aroclor 1254	11097-69-1	1.2E-01	n	9.7E-01	c**	4.9E-03	c	2.1E-02	c	7.8E-03	c**		2.0E-03	c**	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1260	11096-82-5	2.4E-01	c	9.9E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		5.5E-03	c	
				6.0E-04	X			V		1	0.14		~Aroclor 5460	11126-42-4	3.5E+00	n	4.4E+01	n					1.2E+00	n		2.0E-01	n	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.3E-01	c**	5.2E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		2.8E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.2E-01	c**	5.1E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.7E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.2E-01	c**	5.0E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.7E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.2E-01	c**	5.0E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.7E-03	c*	
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V		1	0.14		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.2E-04	c**	5.1E-04	c**	2.5E-06	c*	1.1E-05	c*	4.0E-06	c*		1.7E-06	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.2E-01	c**	4.9E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.2E-01	c**	4.9E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.2E-01	c**	4.9E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.2E-01	c**	5.0E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V		1	0.14		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	3.6E-05	c**	1.5E-04	c**	7.4E-07	c*	3.2E-06	c*	1.2E-06	c*		3.0E-07	c*	
2.0E+00	I	5.7E-04	I					V		1	0.14		~Polychlorinated Biphenyls (high risk)	1336-36-3	2.3E-01	c	9.4E-01	c	4.9E-03	c	2.1E-02	c			5.0E-01			
4.0E-01	I	1.0E-04	I					V		1	0.14		~Polychlorinated Biphenyls (low risk)	1336-36-3					2.8E-02	c	1.2E-01	c	4.4E-02	c	5.0E-01	6.8E-03	c	7.8E-02
7.0E-02	I	2.0E-05	I					V		1	0.14		~Polychlorinated Biphenyls (lowest risk)	1336-36-3					1.4E-01	c	6.1E-01	c			5.0E-01			
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E			1	0.14		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	3.8E-02	c**	1.6E-01	c**	7.4E-04	c*	3.2E-03	c*	6.0E-03	c**		9.4E-04	c**	
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V		1	0.14		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.2E-02	c**	4.8E-02	c**	2.5E-04	c*	1.1E-03	c*	4.0E-04	c*		6.2E-05	c*	
						6.0E-04	I			1	0.1		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	8.5E+04	n	3.6E+05	nm	6.3E-02	n	2.6E-01	n						
													Polynuclear Aromatic Hydrocarbons (PAHs)															
				6.0E-02	I			V		1	0.13		~Acenaphthene	83-32-9	3.6E+02	n	4.5E+03	n					5.3E+01	n		5.5E-01	n	
				3.0E-01	I			V		1	0.13		~Anthracene	120-12-7	1.8E+03	n	2.3E+04	n					1.8E+02	n		5.8E+00	n	
7.3E-01	E	1.1E-04	C					V	M	1	0.13		~Benz[a]anthracene	56-55-3	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	1.2E-02	c		4.2E-03	c	
1.2E+00	C	1.1E-04	C							1	0.13		~Benzo(j)fluoranthene	205-82-3	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	6.5E-02	c		7.8E-02	c	
7.3E+00	I	1.1E-03	C						M	1	0.13		~Benzo[a]pyrene	50-32-8	1.6E-02	c	2.9E-01	c	9.2E-04	c	1.1E-02	c	3.4E-03	c	2.0E-01	4.0E-03	c	2.4E-01
7.3E-01	E	1.1E-04	C						M	1	0.13		~Benzo[b]fluoranthene	205-99-2	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	3.4E-02	c		4.1E-02	c	
7.3E-02	E	1.1E-04	C						M	1	0.13		~Benzo[k]fluoranthene	207-08-9	1.6E+00	c	2.9E+01	c	9.2E-03	c	1.1E-01	c	3.4E-01	c		4.0E-01	c	
				8.0E-02	I			V		1	0.13		~Chloronaphthalene, Beta-	91-58-7	4.8E+02	n	6.0E+03	n					7.5E+01	n		3.9E-01	n	
7.3E-03	E	1.1E-05	C						M	1	0.13		~Chrysene	218-01-9	1.6E+01	c	2.9E+02	c	9.2E-02	c	1.1E+00	c	3.4E+00	c		1.2E+00	c	
7.3E+00	E	1.2E-03	C						M	1	0.13		~Dibenz[a,h]anthracene	53-70-3	1.6E-02	c	2.9E-01	c	8.4E-04	c	1.0E-02	c	3.4E-03	c		1.3E-02	c	
1.2E+01	C	1.1E-03	C							1	0.13		~Dibenzo(a,e)pyrene	192-65-4	4.2E-02	c	1.8E-01	c	2.6E-03	c	1.1E-02	c	6.5E-03	c		8.4E-02	c	
2.5E+02	C	7.1E-02	C						M	1	0.13		~Dimethylbenz(a)anthracene, 7,12-	57-97-6	4.6E-04	c	8.4E-03	c	1.4E-05	c	1.7E-04	c	1.0E-04	c		9.9E-05	c	
				4.0E-02	I					1	0.13		~Fluoranthene	206-44-0	2.4E+02	n	3.0E+03	n					8.0E+01	n		8.9E+00	n	
				4.0E-02	I			V		1	0.13		~Fluorene	86-73-7	2.4E+02	n	3.0E+03	n					2.9E+01	n		5.4E-01	n	
7.3E-01	E	1.1E-04	C						M	1	0.13		~Indeno[1,2,3-cd]pyrene	193-39-5	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	3.4E-02	c		1.3E-01	c	
2.9E-02	P			7.0E-02	A			V		1	0.13	3.9E+02	~Methylnaphthalene, 1-	90-12-0	1.8E+01	c*	7.3E+01	c*					1.1E+00	c*		6.0E-03	c*	
				4.0E-03	I			V		1	0.13		~Methylnaphthalene, 2-	91-57-6	2.4E+01	n	3.0E+02	n					3.6E+00	n		1.9E-02	n	
		3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		~Naphthalene	91-20-3	3.8E+00	c**	1.7E+01	c**	8.3E-02	c**	3.6E-01	c**	1.7E-01	c**		5.4E-04	c**	
1.2E+00	C	1.1E-04	C							1	0.13		~Nitropyrene, 4-	57835-92-4	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	1.9E-02	c		3.3E-03	c	
				3.0E-02	I			V		1	0.13		~Pyrene	129-00-0	1.8E+02	n	2.3E+03	n					1.2E+01	n		1.3E+00	n	
				2.0E-02	P					1	0.1		Potassium Perfluorobutane Sulfonate	29420-49-3	1.3E+02	n	1.6E+03	n					4.0E+01	n		2.2E-02	n	
1.5E-01	I			9.0E-03	I					1	0.1		Prochloraz	67747-09-5	3.6E+00	c*	1.5E+01	c*					3.8E-01	c*		1.9E-03	c*	
				6.0E-03	H			V		1			Profluralin	26399-36-0	4.7E+01	n	7.0E+02	n					2.6E+00	n		1.6E-01	n	
				1.5E-02	I					1	0.1		Prometon	1610-18-0	9.5E+01	n	1.2E+03	n					2.5E+01	n		1.2E-02	n	
				4.0E-03	I					1	0.1		Prometryn	7287-19-6	2.5E+01	n	3.3E+02	n					6.0E+00	n		9.0E-03	n	
				1.3E-02	I					1	0.1		Propachlor	1918-16-7	8.2E+01	n	1.1E+03	n					2.5E+01	n		1.5E-02	n	
				5.0E-03	I					1	0.1		Propanil	709-98-8	3.2E+01	n	4.1E+02	n					8.2E+00	n		4.5E-03	n	
				2.0E-02	I					1	0.1		Propargite	2312-35-8	1.3E+02	n	1.6E+03	n					1.6E+01	n		1.2E+00	n	
				2.0E-03	I			V		1		1.1E+05	Propargyl Alcohol	107-19-7	1.6E+01	n	2.3E+02	n					4.0E+00	n		8.1E-04	n	
				2.0E-02	I					1	0.1		Propazine	139-40-2	1.3E+02	n	1.6E+03	n					3.4E+01	n		3.0E-02	n	
				2.0E-02	I					1	0.1		Propham	122-42-9	1.3E+02	n	1.6E+03	n					3.5E+01	n		2.2E-02	n	
				1.3E-02	I					1	0.1		Propiconazole	60207-90-1	8.2E+01	n	1.1E+03	n					2.1E+01	n		6.9E-02	n	
						8.0E-03	I	V		1		3.3E+04	Propionaldehyde	123-38-6	7.5E+00	n	3.1E+01	n	8.3E-01	n	3.5E+00	n	1.7E+00	n		3.4E-04	n	
				1.0E-01	X	1.0E+00	X	V		1		2.6E+02	Propyl benzene	103-65-1	3.8E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	6.6E+01	n		1.2E-01	n	
						3.0E+00	C	V		1		3.5E+02	Propylene	115-07-1	2.2E+02	n	9.3E+02	ns	3.1E+02	n	1.3E+03	n	6.3E+02	n		6.0E-01	n	
				2.0E+01	P					1	0.1		Propylene Glycol	57-55-6	1.3E+05	nm	1.6E+06	nm					4.0E+04	n		8.1E+00	n	
						2.7E-04	A			1	0.1		Propylene Glycol Dinitrate	6423-43-4	3.9E+04	n	1.6E+05	nm	2.8E-02	n	1.2E-01	n						
				7.0E-01	H	2.0E+00	I	V		1		1.1E+05	Propylene Glycol Monomethyl Ether	107-98-2	4.1E+03	n	3.7E+04	n	2.1E+02	n	8.8E+02	n	3.2E+02	n		6.5E-02	n	
2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	Propylene Oxide	75-56-9	2.1E+00	c*	9.7E+00	c*	7.6E-01	c**	3.3E+00	c**	2.7E-01	c*		5.6E-05	c*	
				7.5E-02	I					1	0.1		Propyzamide	23950-58-5	4.7E+02	n	6.2E+03	n					1.2E+02	n		1.2E-01	n	
				1.0E-03	I			V		1		5.3E+05	Pyridine	110-86-1	7.8E+00	n	1.2E+02	n					2.0E+00	n		6.8E-04	n	
				5.0E-04	I					1	0.1		Quinalphos	13593-03-8	3.2E+00	n	4.1E+01	n					5.1E-01	n		4.3E-03	n	
3.0E+00	I									1	0.1		Quinoline	91-22-5	1.8E-01	c	7.7E-01	c					2.4E-02	c		7.8E-05	c	
				9.0E-03	I					1	0.1		Quizalofop-ethyl	76578-14-8	5.7E+01	n	7.4E+02	n					1.2E+01	n		1.9E-01	n	
						3.0E-02	A			1			Refractory Ceramic Fibers	NA	4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n						
				3.0E-02	I					1	0.1		Resmethrin	10453-86-8	1.9E+02	n	2.5E+03	n					6.7E+00	n		4.2E+00	n	
				5.0E-02	H			V		1			Ronnel	299-84-3	3.9E+02	n	5.8E+03	n					4.1E+01	n		3.7E-01	n	
				4.0E-03	I					1	0.1		Rotenone	83-79-4	2.5E+01	n	3.3E+02	n					6.1E+00	n		3.2E+00	n	
2.2E-01	C	6.3E-05	C						M	1	0.1		Safrole	94-59-7	5.5E-01	c	1.0E+01	c	1.6E-02	c	1.9E-01	c	9.6E-02	c		5.9E-05	c	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels														Protection of Ground Water SSLs			
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				5.0E-03	I					1			Selenious Acid	7783-00-8	3.9E+01	n	5.8E+02	n					1.0E+01	n			n	
				5.0E-03	I	2.0E-02	C			1			Selenium	7782-49-2	3.9E+01	n	5.8E+02	n	2.1E+00	n	8.8E+00	n	1.0E+01	n	5.0E+01	5.2E-02	n	2.6E-01
				5.0E-03	C	2.0E-02	C			1			Selenium Sulfide	7446-34-6	3.9E+01	n	5.8E+02	n	2.1E+00	n	8.8E+00	n	1.0E+01	n			n	
				9.0E-02	I					1	0.1		Sethoxydim	74051-80-2	5.7E+02	n	7.4E+03	n					1.0E+02	n		9.3E-01	n	
						3.0E-03	C			1			Silica (crystalline, respirable)	7631-86-9	4.3E+05	nm	1.8E+06	nm	3.1E-01	n	1.3E+00	n						
				5.0E-03	I					0.04			Silver	7440-22-4	3.9E+01	n	5.8E+02	n					9.4E+00	n		8.0E-02	n	
1.2E-01	H			5.0E-03	I					1	0.1		Simazine	122-34-9	4.5E+00	c**	1.9E+01	c*					6.1E-01	c*	4.0E+00	3.0E-04	c*	2.0E-03
				1.3E-02	I					1	0.1		Sodium Acifluorfen	62476-59-9	8.2E+01	n	1.1E+03	n					2.6E+01	n		2.1E-01	n	
				4.0E-03	I					1			Sodium Azide	26628-22-8	3.1E+01	n	4.7E+02	n					8.0E+00	n			n	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Sodium Dichromate	10588-01-9	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
2.7E-01	H			3.0E-02	I					1	0.1		Sodium Diethyldithiocarbamate	148-18-5	2.0E+00	c*	8.5E+00	c					2.9E-01	c		1.8E-04	c	
				5.0E-02	A	1.3E-02	C			1			Sodium Fluoride	7681-49-4	3.9E+02	n	5.8E+03	n	1.4E+00	n	5.7E+00	n	1.0E+02	n			n	
				2.0E-05	I					1	0.1		Sodium Fluoroacetate	62-74-8	1.3E-01	n	1.6E+00	n					4.0E-02	n		8.1E-06	n	
				1.0E-03	H					1			Sodium Metavanadate	13718-26-8	7.8E+00	n	1.2E+02	n					2.0E+00	n			n	
				8.0E-04	P					1			Sodium Tungstate	13472-45-2	6.3E+00	n	9.3E+01	n					1.6E+00	n			n	
				8.0E-04	P					1			Sodium Tungstate Dihydrate	10213-10-2	6.3E+00	n	9.3E+01	n					1.6E+00	n			n	
2.4E-02	H			3.0E-02	I					1	0.1		Stirofos (Tetrachlorovinphos)	961-11-5	2.3E+01	c**	9.6E+01	c*					2.8E+00	c*		8.2E-03	c*	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Strontium Chromate	7789-06-2	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				6.0E-01	I					1			Strontium, Stable	7440-24-6	4.7E+03	n	7.0E+04	n					1.2E+03	n		4.2E+01	n	
				3.0E-04	I					1	0.1		Strychnine	57-24-9	1.9E+00	n	2.5E+01	n					5.9E-01	n		6.5E-03	n	
				2.0E-01	I	1.0E+00	I	V		1		8.7E+02	Styrene	100-42-5	6.0E+02	n	3.5E+03	ns	1.0E+02	n	4.4E+02	n	1.2E+02	n	1.0E+02	1.3E-01	n	1.1E-01
				3.0E-03	P					1	0.1		Styrene-Acrylonitrile (SAN) Trimer	NA	1.9E+01	n	2.5E+02	n					4.8E+00	n			n	
				1.0E-03	P	2.0E-03	X			1	0.1		Sulfolane	126-33-0	6.3E+00	n	8.2E+01	n	2.1E-01	n	8.8E-01	n	2.0E+00	n		4.4E-04	n	
				8.0E-04	P					1	0.1		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	5.1E+00	n	6.6E+01	n					1.1E+00	n		6.5E-03	n	
						1.0E-03	C	V		1			Sulfur Trioxide	7446-11-9	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n	2.1E-01	n			n	
						1.0E-03	C			1			Sulfuric Acid	7664-93-9	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n						
2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	2.2E+01	c*	9.2E+01	c*	4.0E-01	c	1.7E+00	c	1.3E+00	c*		1.5E-02	c*	
				3.0E-02	H					1	0.1		TCMTB	21564-17-0	1.9E+02	n	2.5E+03	n					4.8E+01	n		3.3E-01	n	
				7.0E-02	I					1	0.1		Tebuthiuron	34014-18-1	4.4E+02	n	5.7E+03	n					1.4E+02	n		3.9E-02	n	
				2.0E-02	H					1	0.1		Temephos	3383-96-8	1.3E+02	n	1.6E+03	n					4.0E+01	n		7.6E+00	n	
				1.3E-02	I					1	0.1		Terbacil	5902-51-2	8.2E+01	n	1.1E+03	n					2.5E+01	n		7.5E-03	n	
				2.5E-05	H			V		1		3.1E+01	Terbufos	13071-79-9	2.0E-01	n	2.9E+00	n					2.4E-02	n		5.2E-05	n	
				1.0E-03	I					1	0.1		Terbutryn	886-50-0	6.3E+00	n	8.2E+01	n					1.3E+00	n		1.9E-03	n	
				1.0E-04	I					1	0.1		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1	6.3E-01	n	8.2E+00	n					2.0E-01	n		5.3E-03	n	
				3.0E-04	I			V		1			Tetrachlorobenzene, 1,2,4,5-	95-94-3	2.3E+00	n	3.5E+01	n					1.7E-01	n		7.9E-04	n	
2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	Tetrachloroethane, 1,1,1,2-	630-20-6	2.0E+00	c	8.8E+00	c	3.8E-01	c	1.7E+00	c	5.7E-01	c*		2.2E-04	c*	
2.0E-01	I	5.8E-05	C	2.0E-02	I			V		1		1.9E+03	Tetrachloroethane, 1,1,2,2-	79-34-5	6.0E-01	c	2.7E+00	c	4.8E-02	c	2.1E-01	c	7.6E-02	c		3.0E-05	c	
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		1		1.7E+02	Tetrachloroethylene	127-18-4	8.1E+00	n	3.9E+01	n	4.2E+00	n	1.8E+01	n	4.1E+00	n	5.0E+00	1.8E-03	n	2.3E-03
				3.0E-02	I					1	0.1		Tetrachlorophenol, 2,3,4,6-	58-90-2	1.9E+02	n	2.5E+03	n					2.4E+01	n		1.8E-02	n	
2.0E+01	H							V		1			Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	3.5E-02	c	1.6E-01	c					1.3E-03	c		4.5E-06	c	
				5.0E-04	I					1	0.1		Tetraethyl Dithiopyrophosphate	3689-24-5	3.2E+00	n	4.1E+01	n					7.1E-01	n		5.2E-04	n	
						8.0E+01	I	V		1		2.1E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2	1.0E+04	ns	4.3E+04	ns	8.3E+03	n	3.5E+04	n	1.7E+04	n		9.3E+00	n	
				2.0E-03	P					1	7E-04		Tetryl (Trinitrophenylmethylnitramine)	479-45-8	1.6E+01	n	2.3E+02	n					3.9E+00	n		3.7E-02	n	
				2.0E-05	S					1			Thallic Oxide	1314-32-5	1.6E-01	n	2.3E+00	n					4.0E-02	n			n	
				1.0E-05	X					1			Thallium (I) Nitrate	10102-45-1	7.8E-02	n	1.2E+00	n					2.0E-02	n			n	
				1.0E-05	X					1			Thallium (Soluble Salts)	7440-28-0	7.8E-02	n	1.2E+00	n					2.0E-02	n	2.0E+00	1.4E-03	n	1.4E-01
				1.0E-05	X			V		1			Thallium Acetate	563-68-8	7.8E-02	n	1.2E+00	n					2.0E-02	n		4.1E-06	n	
				2.0E-05	X			V		1			Thallium Carbonate	6533-73-9	1.6E-01	n	2.3E+00	n					4.0E-02	n		8.3E-06	n	
				1.0E-05	X					1			Thallium Chloride	7791-12-0	7.8E-02	n	1.2E+00	n					2.0E-02	n			n	
				1.0E-05	S					1			Thallium Selenite	12039-52-0	7.8E-02	n	1.2E+00	n					2.0E-02	n			n	
				2.0E-05	X					1			Thallium Sulfate	7446-18-6	1.6E-01	n	2.3E+00	n					4.0E-02	n			n	
				1.3E-02	I					1	0.1		Thifensulfuron-methyl	79277-27-3	8.2E+01	n	1.1E+03	n					2.6E+01	n		7.8E-03	n	
				1.0E-02	I					1	0.1		Thiobencarb	28249-77-6	6.3E+01	n	8.2E+02	n					1.6E+01	n		5.5E-02	n	
				7.0E-02	X					1	0.008		Thiodiglycol	111-48-8	5.4E+02	n	7.9E+03	n					1.4E+02	n		2.8E-02	n	
				3.0E-04	H					1	0.1		Thiofanox	39196-18-4	1.9E+00	n	2.5E+01	n					5.3E-01	n		1.8E-04	n	
				8.0E-02	I					1	0.1		Thiophanate, Methyl	23564-05-8	5.1E+02	n	6.6E+03	n					1.6E+02	n		1.4E-01	n	
				5.0E-03	I					1	0.1		Thiram	137-26-8	3.2E+01	n	4.1E+02	n					9.8E+00	n		1.4E-02	n	
				6.0E-01	H					1			Tin	7440-31-5	4.7E+03	n	7.0E+04	n					1.2E+03	n		3.0E+02	n	
						1.0E-04	A	V		1			Titanium Tetrachloride	7550-45-0	1.4E+04	n	6.0E+04	n	1.0E-02	n	4.4E-02	n	2.1E-02	n			n	
				8.0E-02	I	5.0E+00	I	V		1		8.2E+02	Toluene	108-88-3	4.9E+02	n	4.7E+03	ns	5.2E+02	n	2.2E+03	n	1.1E+02	n	1.0E+03	7.6E-02	n	6.9E-01
		1.1E-05	C			8.0E-06	C	V		1			Toluene-2,4-diisocyante	584-84-9	6.4E-01	n	2.7E+00	n	8.3E-04	n	3.5E-03	n	1.7E-03	n		2.5E-05	n	
1.8E-01	X			2.0E-04	X					1	0.1		Toluene-2,5-diamine	95-70-5	1.3E+00	n	1.3E+01	c**					4.0E-01	n		1.2E-04	n	
		1.1E-05	C			8.0E-06	C	V		1		1.7E+03	Toluene-2,6-diisocyante	91-08-7	5.3E-01	n	2.2E+00	n	8.3E-04	n	3.5E-03	n	1.7E-03	n		2.6E-05	n	
1.6E-02	P	5.1E-05	C							1	0.1		Toluidine, o- (Methylaniline, 2-)	95-53-4	3.4E+01	c	1.4E+02	c	5.5E-02	c	2.4E-01	c	4.7E+00	c		2.0E-03	c	
3.0E-02	P			4.0E-03	X					1	0.1		Toluidine, p-	106-49-0	1.8E+01	c**	7.7E+01	c**					2.5E+00	c**		1.1E-03	c**	
				3.0E+00	P			V		1		3.4E-01	Total Petroleum Hydrocarbons (Aliphatic High)	NA	2.3E+04	ns	3.5E+05	nms					6.0E+03	n		2.4E+02	n	
						6.0E-01	P	V		1		1.4E+02	Total Petroleum Hydrocarbons (Aliphatic Low)	NA	5.2E+01	n	2.2E+02	ns	6.3E+01	n	2.6E+02	n	1.3E+02	n		8.8E-01	n	
				1.0E-02	X	1.0E-01	P	V		1		6.9E+00	Total Petroleum Hydrocarbons (Aliphatic Medium)	NA	9.6E+00	ns	4.4E+01	ns	1.0E+01	n	4.4E+01	n	1.0E+01	n		1.5E-01	n	
				4.0E-02	P					1	0.1		Total Petroleum Hydrocarbons (Aromatic High)	NA	2.5E+02	n	3.3E+03	n					8.0E+01	n		8.9E+00	n	
				4.0E-03	P	3.0E-02	P	V		1		1.8E+03	Total Petroleum Hydrocarbons (Aromatic Low)	NA	8.2E+00	n	4.2E+01	n	3.1E+00	n	1.3E+01	n	3.3E+00	n		1.7E-03	n	
				4.0E-03	P	3.0E-03	P	V		1			Total Petroleum Hydrocarbons (Aromatic Medium)	NA	1.1E+01	n	6.0E+01	n	3.1E-01	n	1.3E+00	n	5.5E-01	n		2.3E-03	n	
1.1E+00	I	3.2E-04	I							1	0.1		Toxaphene	8001-35-2	4.9E-01	c	2.1E+00	c	8.8E-03	c	3.8E-02	c	7.1E-02	c	3.0E+00	1.1E-02	c	4.6E-01
				7.5E-03	I					1	0.1		Tralomethrin	66841-25-6	4.7E+01	n	6.2E+02	n					1.5E+01	n		5.8E+00	n	
				3.0E-04	A			V		1			Tri-n-butyltin	688-73-3	2.3E+00	n	3.5E+01	n					3.7E-01	n		8.2E-03	n	
				8.0E+01	X					1	0.1		Triacetin	102-76-1	5.1E+05	nm	6.6E+06	nm					1.6E+05	n		4.5E+01	n	

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Toxicity and Chemical-specific Information												Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.0E-02	I					1	0.1		Triadimefon	43121-43-3	1.9E+02	n	2.5E+03	n					5.5E+01	n		4.4E-02	n	
				1.3E-02	I			V		1			Triallate	2303-17-5	1.0E+02	n	1.5E+03	n					1.2E+01	n		2.6E-02	n	
				1.0E-02	I					1	0.1		Triasulfuron	82097-50-5	6.3E+01	n	8.2E+02	n					2.0E+01	n		2.1E-02	n	
				8.0E-03	I					1	0.1		Tribenuron-methyl	101200-48-0	5.1E+01	n	6.6E+02	n					1.6E+01	n		1.6E-03	n	
				5.0E-03	I			V		1			Tribromobenzene, 1,2,4-	615-54-3	3.9E+01	n	5.8E+02	n					4.5E+00	n		6.4E-03	n	
9.0E-03	P			1.0E-02	P					1	0.1		Tributyl Phosphate	126-73-8	6.0E+01	c**	2.6E+02	c**					5.2E+00	c**		2.5E-02	c**	
				3.0E-04	P					1	0.1		Tributyltin Compounds	NA	1.9E+00	n	2.5E+01	n					6.0E-01	n			n	
				3.0E-04	I					1	0.1		Tributyltin Oxide	56-35-9	1.9E+00	n	2.5E+01	n					5.7E-01	n		2.9E+01	n	
				3.0E+01	I	3.0E+01	H	V		1		9.1E+02	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	4.0E+03	ns	1.7E+04	ns	3.1E+03	n	1.3E+04	n	5.5E+03	n		1.4E+01	n	
7.0E-02	I			2.0E-02	I					1	0.1		Trichloroacetic Acid	76-03-9	7.8E+00	c*	3.3E+01	c*					1.1E+00	c*	6.0E+01	2.2E-04	c*	1.2E-02
2.9E-02	H									1	0.1		Trichloroaniline HCl, 2,4,6-	33663-50-2	1.9E+01	c	7.9E+01	c					2.7E+00	c		7.4E-03	c	
7.0E-03	X			3.0E-05	X					1	0.1		Trichloroaniline, 2,4,6-	634-93-5	1.9E-01	n	2.5E+00	n					4.0E-02	n		3.6E-04	n	
				8.0E-04	X			V		1			Trichlorobenzene, 1,2,3-	87-61-6	6.3E+00	n	9.3E+01	n					7.0E-01	n		2.1E-03	n	
2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	Trichlorobenzene, 1,2,4-	120-82-1	5.8E+00	n	2.6E+01	n	2.1E-01	n	8.8E-01	n	4.0E-01	n	7.0E+01	1.2E-03	n	2.0E-01
				2.0E+00	I	5.0E+00	I	V		1		6.4E+02	Trichloroethane, 1,1,1-	71-55-6	8.1E+02	ns	3.6E+03	ns	5.2E+02	n	2.2E+03	n	8.0E+02	n	2.0E+02	2.8E-01	n	7.0E-02
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V		1		2.2E+03	Trichloroethane, 1,1,2-	79-00-5	1.5E-01	n	6.3E-01	n	2.1E-02	n	8.8E-02	n	4.1E-02	n	5.0E+00	1.3E-05	n	1.6E-03
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1		6.9E+02	Trichloroethylene	79-01-6	4.1E-01	n	1.9E+00	n	2.1E-01	n	8.8E-01	n	2.8E-01	n	5.0E+00	1.0E-04	n	1.8E-03
				3.0E-01	I			V		1		1.2E+03	Trichlorofluoromethane	75-69-4	2.3E+03	ns	3.5E+04	ns					5.2E+02	n		3.3E-01	n	
				1.0E-01	I					1	0.1		Trichlorophenol, 2,4,5-	95-95-4	6.3E+02	n	8.2E+03	n					1.2E+02	n		4.0E-01	n	
1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		Trichlorophenol, 2,4,6-	88-06-2	6.3E+00	n	8.2E+01	n	9.1E-01	c	4.0E+00	c	1.2E+00	n		1.2E-03	n	
				1.0E-02	I					1	0.1		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	6.3E+01	n	8.2E+02	n					1.6E+01	n		6.8E-03	n	
				8.0E-03	I					1	0.1		Trichlorophenoxypropionic acid, -2,4,5	93-72-1	5.1E+01	n	6.6E+02	n					1.1E+01	n	5.0E+01	6.1E-03	n	2.8E-02
				5.0E-03	I			V		1		1.3E+03	Trichloropropane, 1,1,2-	598-77-6	3.9E+01	n	5.8E+02	n					8.8E+00	n		3.5E-03	n	
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	Trichloropropane, 1,2,3-	96-18-4	5.1E-03	c*	1.1E-01	c*	3.1E-02	n	1.3E-01	n	7.5E-04	c*		3.2E-07	c*	
				3.0E-03	X	3.0E-04	P	V		1		3.1E+02	Trichloropropene, 1,2,3-	96-19-5	7.3E-02	n	3.1E-01	n	3.1E-02	n	1.3E-01	n	6.2E-02	n		3.1E-05	n	
				2.0E-02	A					1	0.1		Tricresyl Phosphate (TCP)	1330-78-5	1.3E+02	n	1.6E+03	n					1.6E+01	n		1.5E+00	n	
				3.0E-03	I					1	0.1		Tridiphane	58138-08-2	1.9E+01	n	2.5E+02	n					1.8E+00	n		1.3E-02	n	
						7.0E-03	I	V		1		2.8E+04	Triethylamine	121-44-8	1.2E+01	n	4.8E+01	n	7.3E-01	n	3.1E+00	n	1.5E+00	n		4.4E-04	n	
				2.0E+00	P					1	0.1		Triethylene Glycol	112-27-6	1.3E+04	n	1.6E+05	nm					4.0E+03	n		8.8E-01	n	
						2.0E+01	P	V		1		4.8E+03	Trifluoroethane, 1,1,1-	420-46-2	1.5E+03	n	6.2E+03	ns	2.1E+03	n	8.8E+03	n	4.2E+03	n		1.3E+01	n	
7.7E-03	I			7.5E-03	I			V		1			Trifluralin	1582-09-8	5.9E+01	n	4.2E+02	c**					2.6E+00	c**		8.4E-02	c**	
2.0E-02	P			1.0E-02	P					1	0.1		Trimethyl Phosphate	512-56-1	2.7E+01	c**	1.1E+02	c**					3.9E+00	c**		8.6E-04	c**	
						5.0E-03	P	V		1		2.9E+02	Trimethylbenzene, 1,2,3-	526-73-8	4.9E+00	n	2.1E+01	n	5.2E-01	n	2.2E+00	n	1.0E+00	n		1.5E-03	n	
						7.0E-03	P	V		1		2.2E+02	Trimethylbenzene, 1,2,4-	95-63-6	5.8E+00	n	2.4E+01	n	7.3E-01	n	3.1E+00	n	1.5E+00	n		2.1E-03	n	
				1.0E-02	X			V		1		1.8E+02	Trimethylbenzene, 1,3,5-	108-67-8	7.8E+01	n	1.2E+03	ns					1.2E+01	n		1.7E-02	n	
				1.0E-02	X			V		1		3.0E+01	Trimethylpentene, 2,4,4-	25167-70-8	7.8E+01	ns	1.2E+03	ns					6.5E+00	n		2.2E-02	n	
				3.0E-02	I					1	0.019		Trinitrobenzene, 1,3,5-	99-35-4	2.2E+02	n	3.2E+03	n					5.9E+01	n		2.1E-01	n	
3.0E-02	I			5.0E-04	I					1	0.032		Trinitrotoluene, 2,4,6-	118-96-7	3.6E+00	n	5.1E+01	n					9.8E-01	n		5.7E-03	n	
				2.0E-02	P					1	0.1		Triphenylphosphine Oxide	791-28-6	1.3E+02	n	1.6E+03	n					3.6E+01	n		1.5E-01	n	
				2.0E-02	A					1	0.1		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	1.3E+02	n	1.6E+03	n					3.6E+01	n		8.0E-01	n	
				1.0E-02	X					1	0.1		Tris(1-chloro-2-propyl)phosphate	13674-84-5	6.3E+01	n	8.2E+02	n					1.9E+01	n		6.5E-02	n	
2.3E+00	C	6.6E-04	C					V		1		4.7E+02	Tris(2,3-dibromopropyl)phosphate	126-72-7	2.8E-01	c	1.3E+00	c	4.3E-03	c	1.9E-02	c	6.8E-03	c		1.3E-04	c	
2.0E-02	P			7.0E-03	P					1	0.1		Tris(2-chloroethyl)phosphate	115-96-8	2.7E+01	c**	1.1E+02	c**					3.8E+00	c**		3.8E-03	c**	
3.2E-03	P			1.0E-01	P					1	0.1		Tris(2-ethylhexyl)phosphate	78-42-2	1.7E+02	c**	7.2E+02	c*					2.4E+01	c**		1.2E+02	c**	
				8.0E-04	P					1			Tungsten	7440-33-7	6.3E+00	n	9.3E+01	n					1.6E+00	n		2.4E-01	n	
				3.0E-03	I	4.0E-05	A			1			Uranium (Soluble Salts)	NA	2.3E+01	n	3.5E+02	n	4.2E-03	n	1.8E-02	n	6.0E+00	n	3.0E+01	2.7E+00	n	1.4E+01
1.0E+00	C	2.9E-04	C						M	1	0.1		Urethane	51-79-6	1.2E-01	c	2.3E+00	c	3.5E-03	c	4.2E-02	c	2.5E-02	c		5.6E-06	c	
		8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			Vanadium Pentoxide	1314-62-1	6.6E+01	n	8.4E+02	n	3.4E-04	c**	1.5E-03	c**	1.5E+01	n			n	
				5.0E-03	S	1.0E-04	A			0.026			Vanadium and Compounds	7440-62-2	3.9E+01	n	5.8E+02	n	1.0E-02	n	4.4E-02	n	8.6E+00	n		8.6E+00	n	
				1.0E-03	I			V		1			Vernolate	1929-77-7	7.8E+00	n	1.2E+02	n					1.1E+00	n		8.9E-04	n	
				2.5E-02	I					1	0.1		Vinclozolin	50471-44-8	1.6E+02	n	2.1E+03	n					4.4E+01	n		3.4E-02	n	
				1.0E+00	H	2.0E-01	I	V		1		2.8E+03	Vinyl Acetate	108-05-4	9.1E+01	n	3.8E+02	n	2.1E+01	n	8.8E+01	n	4.1E+01	n		8.7E-03	n	
		3.2E-05	H			3.0E-03	I	V		1		2.5E+03	Vinyl Bromide	593-60-2	1.2E-01	c**	5.2E-01	c**	8.8E-02	c**	3.8E-01	c**	1.8E-01	c**		5.1E-05	c**	
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	Vinyl Chloride	75-01-4	5.9E-02	c	1.7E+00	c*	1.7E-01	c*	2.8E+00	c*	1.9E-02	c	2.0E+00	6.5E-06	c	6.9E-04
				3.0E-04	I					1	0.1		Warfarin	81-81-2	1.9E+00	n	2.5E+01	n					5.6E-01	n		5.9E-04	n	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, P-	106-42-3	5.6E+01	n	2.4E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n		1.9E-02	n	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, m-	108-38-3	5.5E+01	n	2.4E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n		1.9E-02	n	
				2.0E-01	S	1.0E-01	S	V		1		4.3E+02	Xylene, o-	95-47-6	6.5E+01	n	2.8E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n		1.9E-02	n	
				2.0E-01	I	1.0E-01	I	V		1		2.6E+02	Xylenes	1330-20-7	5.8E+01	n	2.5E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n	1.0E+04	1.9E-02	n	9.9E+00
				3.0E-04	I					1			Zinc Phosphide	1314-84-7	2.3E+00	n	3.5E+01	n					6.0E-01	n			n	
				3.0E-01	I					1			Zinc and Compounds	7440-66-6	2.3E+03	n	3.5E+04	n					6.0E+02	n		3.7E+01	n	
				5.0E-02	I					1	0.1		Zineb	12122-67-7	3.2E+02	n	4.1E+03	n					9.9E+01	n		2.9E-01	n	
				8.0E-05	X					1			Zirconium	7440-67-7	6.3E-01	n	9.3E+00	n					1.6E-01	n		4.8E-01	n	

Toxicity Characteristic - Maximum Concentration of Contaminants

(Determine Levels using TCLP, Test Method 1311, EPA SW-846)

40CFR 261.24

USEPA Hazardous Waste Number	Constituent	CAS Number	Regulatory Level (mg/l)
D004	**Arsenic**	7440-38-2	**5.0**
D005	**Barium**	7440-39-3	**100.0**
D018 vol	Benzene	71-43-2	0.5
D006	**Cadmium**	7440-43-9	**1.0**
D019 vol	Carbon Tetrachloride	56-23-5	0.5
D020 pest	Chlordane	57-74-9	0.03
D021 vol	Chlorobenzene	108-90-7	100.0
D022 vol	Chloroform	67-66-3	6.0
D007	**Chromium**	7440-47-3	**5.0**
D023 semivol	o-Cresol	95-48-7	200.0*
D024 semivol	m-Cresol	108-39-4	200.0*
D025 semivol	p-Cresol	106-44-5	200.0*
D026 semivol	Cresol	- - -- - - - -	200.0*
D016 herbicide	2,4-D	94-75-7	10.0
D027 vol	1,4-Dichlorobenzene	106-46-7	7.5
D028 vol	1,2-Dichloroethane	107-06-2	0.5
D029 vol	1,1-Dichloroethylene	75-35-4	0.7
D030 semivol	2,4-Dinitrotoluene	121-14-2	0.13
D012 pest	Endrin	72-20-8	0.02
D031 pest	Heptachlor, and its epoxide	76-44-8	0.008
D032 semivol	Hexachlorobenzene	118-74-1	0.13
D033 semivol	Hexachloro-1,3-butadiene	87-68-3	0.5
D034 semivol	Hexachloroethane	67-72-1	3.0
D008	**Lead**	7439-92-1	**5.0**
D013 pest	Lindane	58-89-9	0.4
D009	**Mercury**	7439-97-6	**0.2**
D014 pest	Methoxychlor	72-43-5	10.0
D035 vol	Methyl Ethyl Ketone (MEK) (2-Butanone)	78-93-3	200.0
D036 semivol	Nitrobenzene	98-95-3	2.0
D037 semivol	Pentachlorophenol	87-86-5	100.0
D038 semivol	Pyridine	110-86-1	5.0
D010	**Selenium**	7782-49-2	**1.0**
D011	**Silver**	7440-22-4	**5.0**
D039 vol	Tetrachloroethylene	127-18-4	0.7
D015 pest	Toxaphene	8001-35-2	0.5
D040 vol	Trichloroethylene	79-01-6	0.5
D041 semivol	2,4,5-Trichlorophenol	95-95-4	400.
D042 semivol	2,4,6-Trichlorophenol	88-06-2	2.0
D017 herbicide	2,4,5-TP (Silvex)	93-72-1	1.0
D043 vol	Vinyl Chloride	75-01-4	0.2

* If the o-, m-, and /or p-Cresol concentrations cannot be differentiated, then the total cresol (D026) concentration (200 ppm) is used.

Compounds presented in **blue** are the RCRA eight priority metals

Vol – Volatile organic compound

Semivol – Semi volatile organic compound

Pest - Pesticide

Colorado Department of Public Health and Environment (CDPHE)
Hazardous Materials and Waste Management Division

Groundwater Protection Values Soil Cleanup Table

Class	Analyte (CDPHE Preferred Name)	CAS No.	Groundwater Protection Level		Leachate Reference Concentration		Water Standard	
			[mg/kg]	Notes	[mg/L]	Notes	[mg/L]	Notes
Inorganics	Aluminum	7429-90-5	NA		110		5	1,3
	Antimony	7440-36-0	NA		0.13		0.006	1
	Arsenic	7440-38-2	NA		0.22		0.01	1
	Barium	7440-39-3	NA		44		2	1
	Beryllium	7440-41-7	NA		0.088		0.004	1
	Cadmium and compounds	7440-43-9	NA		0.11		0.005	1
	Chromium(III)	16065-83-1	NA		2.2	6	0.1	1,6
	Chromium(VI) particulates	18540-29-9	NA		0.015		0.0007	2
	Cobalt	7440-48-4	NA		1.1		0.05	1,3
	Copper and compounds	7440-50-8	NA		4.4		0.2	1,3
	Iron	7439-89-6	NA		6.6		0.3	1
	Lead (inorganic)	7439-92-1	NA		1.1		0.05	1
	Lead (tetraethyl)	78-00-2	NA		0.000015		7E-07	2
	Manganese	7439-96-5	NA		1.1		0.05	1
	Mercury (elemental)	7439-97-6	NA		0.025		0.0011	2
	Mercury compounds (i.e., HgCl)	7487-94-7	NA		0.044		0.002	1
	Nickel (soluble salts)	7440-02-0	NA		2.2		0.1	1
	Selenium	7782-49-2	NA		0.44		0.02	1,3
	Silver	7440-22-4	NA		1.1		0.05	1
	Thallium (sulfate etc.)	7440-28-0	NA		0.044		0.002	1
	Vanadium	7440-62-2	NA		2.2		0.1	1,3
	Zinc	7440-66-6	NA		44		2	1,3
	1,1,1,2-Tetrachloroethane	630-20-6	0.16		NA		0.013	2
	1,1,1-Trichloroethane	71-55-6	62		NA		0.2	1,4
			1,000	5	NA		14	1,4
	1,1,2,2-Tetrachloroethane	79-34-5	0.0024		NA		0.00018	1
	1,1,2-Trichloroethane	79-00-5	0.038		NA		0.0028	1
	1,1-Dichloroethane	75-34-3	1.8		NA		0.061	2
	1,1-Dichloroethylene	75-35-4	12		NA		0.007	1
	1,2,3-Trichloropropane	96-18-4	4.80E-04		NA		3.70E-07	1
	1,2,4-Trichlorobenzene	120-82-1	13		NA		0.07	1
	1,2-Dibromo-3-chloropropane	96-12-8	0.002		NA		0.0002	1
	1,2-Dibromoethane	106-93-4	0.00018		NA		0.00002	1
	1,2-Dichlorobenzene	95-50-1	57		NA		0.6	1
	1,2-Dichloroethane	107-06-2	0.0036		NA		0.00038	1
	1,2-Dichloropropane	78-87-5	0.0087		NA		0.00052	1
	1,3,5-Trimethylbenzene	108-67-8	23		NA		0.07	2
	1,3-Dichlorobenzene	541-73-1	8.5		NA		0.094	1
	1,3-Dichloropropene	542-75-6	0.084		NA		0.0035	2
	1,4-Dichlorobenzene	106-46-7	7.8		NA		0.075	1
	1-Methylnaphthalene	90-12-0	0.81		NA		0.012	2
	2-Butanone	78-93-3	18		NA		4.2	2
	2-Chlorophenol	95-57-8	1.2		NA		0.035	1
	2-Hexanone	591-78-6	0.21		NA		0.035	1
	2-Methylnaphthalene	91-57-6	7.4		NA		0.028	2
	4-Methyl-2-pentanone	108-10-1	3.3		NA		0.56	2
	Acenaphthene	83-32-9	1000	5	NA		0.42	1
	Acetone	67-64-1	32		NA		6.3	1
	Acetophenone	98-86-2	5.2		NA		0.7	2
	Anthracene	120-12-7	1000	5	NA		2.1	1
	Benzene	71-43-2	0.17		NA		0.005	1

Class	Analyte (CDPHE Preferred Name)	CAS No.	Groundwater Protection Level		Leachate Reference Concentration		Water Standard	
			[mg/kg]	Notes	[mg/L]	Notes	[mg/L]	Notes
VOCs	beta-Chloronaphthalene	91-58-7	1000	5	NA		0.56	1
	Bis(2-chloroisopropyl)ether	108-60-1	0.037		NA		0.005	2
	Bromobenzene	108-86-1	3		NA		0.056	2
	Bromodichloromethane	75-27-4	0.007		NA		0.00056	1
	Bromomethane	74-83-9	0.16		NA		0.01	2
	Carbon disulfide	75-15-0	1000	5	NA		0.7	2
	Carbon tetrachloride	56-23-5	1.704		NA		0.0005	1
	Chlorobenzene	108-90-7	5.3		NA		0.1	1
	Chloroform	67-66-3	0.085		NA		0.0035	1
	cis-1,2-Dichloroethene	156-59-2	0.261		NA		0.014	1
	Cumene	98-82-8	700		NA		0.7	2
	Dibenzofuran	132-64-9	4.1		NA		0.007	2
	Dibromochloromethane	124-48-1	0.11		NA		0.014	1
	Dichlorodifluoromethane	75-71-8	390		NA		1.4	2
	Ethyl ether	60-29-7	11		NA		1.4	2
	Ethyl methacrylate	97-63-2	1000	5	NA		0.63	2
	Ethylacetate	141-78-6	35		NA		6.3	2
	Ethylbenzene	100-41-4	100		NA		0.7	1
	Fluorene	86-73-7	1000	5	NA		0.28	1
	Hexane	110-54-3	100		NA		0.42	2
	Methylene chloride	75-09-2	0.06		NA		0.005	1
	Naphthalene	91-20-3	23		NA		0.14	1
	Nitrobenzene	98-95-3	0.239		NA		0.014	1
	n-Propylbenzene	103-65-1	77		NA		0.7	2
	Styrene	100-42-5	14		NA		0.1	1
	Tetrachloroethylene	127-18-4	1.9		NA		0.005	1,4
			6.35		NA		0.017	1,4
	Toluene	108-88-3	50		NA		0.56	1
	Total 1,2-dichloroethene	540-59-0	1.9		NA		0.063	2
	Xylenes (total)	1330-20-7	75		NA		1.4	1
	trans-1,2-Dichloroethene	156-60-5	5.4		NA		0.1	1
	Trichloroethylene	79-01-6	0.68		NA		0.005	1
	Trichlorofluoromethane	75-69-4	1000	5	NA		2.1	2
	Trichlorotrifluoroethane	76-13-1	1000	5	NA		210	2
	Vinyl acetate	108-05-4	51		NA		7	2
	Vinyl chloride	75-01-4	0.11		NA		0.000023	1
SVOCs	1,2-Dinitrobenzene	528-29-0	0.014		NA		0.0007	2
	1,4-Dinitrobenzene	100-25-4	0.005		NA		0.0007	2
	1,4-Dioxane	123-91-1	0.0016		NA		3.50E-04	1
	2,4,5-Trichlorophenol	95-95-4	88		NA		0.7	1
	2,4,6-Trichlorophenol	88-06-2	0.28		NA		0.0032	1
	2,4-Dichlorophenol	120-83-2	0.33		NA		0.021	1
	2,4-Dimethylphenol	105-67-9	2.7		NA		0.14	1
	2,4-Dinitrophenol	51-28-5	0.4		NA		0.014	1
	2-Methylphenol	95-48-7	1.2		NA		0.35	2
	3,3'-Dichlorobenzidine	91-94-1	0.041		NA		0.000078	1
	3-Methylphenol	108-39-4	1.2		NA		0.35	2
	4-Methylphenol	106-44-5	0.27		NA		0.035	2
	4-Nitrophenol	100-02-7	2.1		NA		0.056	1
	Benz[a]anthracene	56-55-3	1000	5	NA		4.8E-06	1
	Benzo[a]pyrene	50-32-8	1000	5	NA		4.8E-06	1
	Benzo[b]fluoranthene	205-99-2	1000	5	NA		4.8E-06	1
	Benzo[k]fluoranthene	207-08-9	1000	5	NA		4.8E-06	1
	Benzoic acid at pH 6.8	65-85-0	110		NA		28	2
	Benzyl alcohol	100-51-6	3.9		NA		0.7	2
	Bis-2-ethylhexyl phthalate	117-81-7	1000	5	NA		0.0025	1
	Bromoform	75-25-2	0.048		NA		0.004	1
	Butylbenzylphthalate	85-68-7	1000	5	NA		1.4	1
	Chlordane	57-74-9	1000	5	NA		0.0001	1
	Chrysene	218-01-9	1000	5	NA		4.8E-06	1

Class	Analyte (CDPHE Preferred Name)	CAS No.	Groundwater Protection Level		Leachate Reference Concentration		Water Standard	
			[mg/kg]	Notes	[mg/L]	Notes	[mg/L]	Notes
	Cyclohexanone	108-94-1	200		NA		35	2
	Dibenzo[a,h]anthracene	53-70-3	1000	5	NA		4.8E-06	1
	Diethylphthalate	84-66-2	140		NA		5.6	1
	di-n-Butyl phthalate	84-74-2	1000	5	NA		0.7	1
	diphenylamine	122-39-4	32		NA		0.18	2
	Ethylene glycol	107-21-1	70		NA		14	2
	Fluoranthene	206-44-0	1000	5	NA		0.28	1
	Hexachlorobenzene	118-74-1	0.009		NA		0.000022	1
	Hexachlorobutadiene	87-68-3	0.17		NA		0.00045	1
	Hexachlorocyclopentadiene	77-47-4	1000	5	NA		0.042	1
	Hexachloroethane	67-72-1	0.019		NA		8.80E-04	1
	Indeno[1,2,3-cd]pyrene	193-39-5	1000	5	NA		4.8E-06	1
	N-nitrosodimethylamine	62-75-9	0.000005		NA		6.9E-07	1
	N-Nitrosodinpropylamine	621-64-7	2.8E-07		NA		0.000005	1
	N-Nitrosodiphenylamine	86-30-6	0.67		NA		0.0071	1
	Pentachlorophenol	87-86-5	0.021		NA		8.80E-05	1
	Phenol	108-95-2	47		NA		2.1	1
	Pyrene	129-00-0	1000	5	NA		0.21	1
	Pyridine	110-86-1	0.38		NA		0.007	2
PCBs	Aroclor 1016	12674-11-2	1000	5	NA		0.000017	1
	Aroclor 1254	11097-69-1	1000	5	NA		0.000017	1
	Aroclor 1260	11096-82-5	1000	5	NA		0.000017	1
	PCBs	1336-36-3	1000	5	NA		0.000017	1
Pesticides	2,4,5-T	93-76-5	0.54		NA		0.07	2
	2,4,5-TP	93-72-1	0.48		NA		0.05	1
	2,4-D	94-75-7	2.5		NA		0.07	1
	2,4-DB	94-82-6	2.1		NA		0.056	2
	4,4'-DDD	72-54-8	1000	5	NA		0.00015	1
	4,4'-DDE	72-55-9	1000	5	NA		0.0001	1
	4,4'-DDT	50-29-3	1000	5	NA		0.0001	1
	Aldicarb sulfone	1646-88-4	0.035		NA		0.007	1
	Aldrin	309-00-2	1000	5	NA		2.1E-06	1
	alpha-BHC	319-84-6	0.0017		NA		5.6E-06	1
	beta-BHC	319-85-7	0.046		NA		0.00019	2
	Dalapon	75-99-0	1.1		NA		0.2	1
	Dieldrin	60-57-1	1000	5	NA		0.000002	1
	Dinoseb	88-85-7	0.62		NA		0.007	1
	Endosulfan I	115-29-7	1000	5	NA		0.042	1
	Endosulfan II	33213-65-9	1000	5	NA		0.042	1
	Endosulfan Sulfate	1031-07-8	1000	5	NA		0.042	1
	Endrin	72-20-8	1000	5	NA		0.002	1
	Endrin aldehyde	7421-93-4	4.9		NA		0.0021	1
	gamma-BHC	58-89-9	0.017		NA		0.0002	1
	Heptachlor	76-44-8	1000	5	NA		0.000008	1
	Heptachlor epoxide	1024-57-3	1000	5	NA		0.000004	1
	Isophorone	78-59-1	1.3		NA		0.14	1
	MCPA	94-74-6	0.028		NA		0.0035	2
	MCPP	93-65-2	0.054		NA		0.007	2
	Methoxychlor	72-43-5	1000		NA		0.035	1
	Phorate	298-02-2	0.15		NA		0.0014	2
	Terbufos	13071-79-9	0.031		NA		0.00018	2
	Toxaphene	8001-35-2	1000	5	NA		0.000032	1
Explosives	2,4,6-Trinitrotoluene	118-96-7	1.7		NA		0.012	2
	2,4/2,6-Dinitrotoluene mix	25321-14-6	0.015		NA		0.00051	2
	2,4-Dinitrotoluene	121-14-2	0.0032		NA		0.00011	1
	2,6-Dinitrotoluene	606-20-2	0.2		NA		0.007	2
	2-Amino-4,6-dinitrotoluene	35572-78-2	0.16		NA		0.014	2
	4-Amino-2,6-dinitrotoluene	19406-51-0	0.16		NA		0.014	2
	4-Nitrotoluene	99-99-0	0.59		NA		0.022	2
	Tetryl	479-45-8	0.6		NA		0.028	2

Class	Analyte (CDPHE Preferred Name)	CAS No.	Groundwater Protection Level		Leachate Reference Concentration		Water Standard	
			[mg/kg]	Notes	[mg/L]	Notes	[mg/L]	Notes
Anions	Cyanide (free)	57-12-5	NA		4.4		0.2	1
	Cyanide (hydrogen)	74-90-8	NA		3.1		0.14	2
	Nitrate	14797-55-8	NA		220		10	1
	Nitrite	14797-65-0	NA		22		1	1

NOTES:

1. Water standard based on current state groundwater standard or federal Maximum Concentration Level (MCL).
2. Water standard based on Maximum Concentration Level (MCL)-equivalent calculation.
3. Water standard based on state agricultural standard.
4. When two groundwater protection levels are listed for the same consituent, the division will determine the applicable protection level based upon current and potential future uses of groundwater.
5. Table value is capped at a maximum concentration of 1,000 mg/kg to account for the possibility that at high concentrations free phase material may be present and to protect against acute health impacts.
6. Based on total chromium.

NA - Not applicable.

VOCs - Volatile organic carbons

SVOCs - Semi-volatile organic carbons

PCBs - Polychlorinated biphenyls

Appendix C DEH Guidance for Third Party Reuse of Excess Soil from City Projects

Department of Environmental Health
Division of Environmental Quality
200 W 14th Ave, Suite 310
Denver, CO 80204
p: 720-913-1311
f: 720-865-5534
www.denvergov.org/deh

INTEROFFICE MEMORANDUM

TO: City and County of Denver Department Executive Directors

FROM: Doug Linkhart, Executive Director

DATE: April 29, 2015

SUBJECT: Guidance for Third Party Reuse of Excess Soil from City Projects

There is increasing demand in and around the City and County of Denver (City) for soil available for reuse. City projects sometimes generate excess soil that potentially could be reused. Such reuse offers several benefits to the City including reduced hauling costs, disposal fees, and vehicle emissions. The soil must be adequately characterized based on the intended reuse in order to protect public health and the environment. If contaminated, the soil must be disposed at the City-owned Denver Arapahoe Disposal Site (DADS) in accordance with Executive Order 115. If the soil meets the Colorado Department of Public Health and Environment (CDPHE) regulatory standards and guidance, the Department of Environmental Health (DEH) encourages its reuse.

This guidance provides procedures and criteria by which contractors and third parties may, or may not, reuse excess soil from City projects at non-City sites.

As such, to promote safe and sustainable reuse, it is within DEH's purview to implement the following requirements for City excess soils to be reused:

1. City personnel are responsible for contacting the City's Department of Environmental Health (DEH)[1] when they receive a contractor or third party request to reuse soil. DEH is responsible for promptly informing the contractor or third party of City sampling and analysis requirements, which are designed to promote safe and sustainable reuse.
2. Soil must be adequately characterized by sampling utilizing a sampling plan and methodology sufficient to evaluate the equivalent of at least every 500 cubic yards to be excavated.
3. Analyze those soil samples for, at a minimum:
    a. Volatile organic constituents

[1] Diane DeLillio, 720-865-5448, diane.delillio@denvergov.org

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THE MILE HIGH CITY

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   b. Semi-volatile organic constituents
   c. Total petroleum hydrocarbons
   d. Pesticides
   e. Herbicides
   f. PCBs
   g. Arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver
   h. Asbestos.
4. The sampling and analysis must be conducted by environmental professionals approved by DEH.
5. The party requesting the excess soil shall pay all costs associated with the sampling and analysis of the soil.
6. Before the City will release the soil for reuse, the party requesting the excess soil must demonstrate to DEH's satisfaction that the soil meets either CDPHE's most restrictive criteria for residential soil or applicable CDPHE criteria based on the designated land use of the receiving site.
7. DEH maintains the documentation for sample collection, analytical results, and the environmental consultant's field notes and evaluation.
8. The party will be required to sign a release to accept the soil from the City and to release the City from liability.

CC: Jessica Brody, CAO
Zach Clayton, DEH
Gregg Thomas, DEH

Appendix D Project Specific RACS Management Plan

Appendix E Remediation Activities Discharging to Surface Water Permit Information

COLORADO
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

For Agency Use Only:
Permit Number Assigned
COG07 - _____
COG315 -_____
COG316 -_____

Application for COLORADO DISCHARGE PERMIT SYSTEM (CDPS) General Permits:

- **Construction Dewatering** (COG070000)
- **Remediation Activities Discharging To Surface Water** (COG315000), or
- **Remediation Activities Discharging To Groundwater** (COG316000)

Please print or type. Original signatures are required. Photo, faxed, pdf or email copies will not be accepted.

This combined permit application is designed to streamline the application process for the three types of discharge permits listed in Part A below, and includes an *Application Guidance Document* to help applicants complete the application and select the right permit coverage for their activity. Please note that **one** application is intended to cover **one** project and **one** type of permit. Where multiple projects or types of permits are required, please submit an appropriate number of permit applications.

The application must be submitted to the Water Quality Control Division at least 30 days (for Construction Dewatering) or 45 days (for Remediation) prior to the anticipated date of discharge, and must be considered complete by the division before the review and approval process begins. The division will notify the applicant if additional information is needed to complete the application. If more space is required to answer any question, please attach additional sheets to the application form. Applications must be submitted by mail or hand delivered to:

Colorado Department of Public Health and Environment
Water Quality Control Division, WQCD-P-B2
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

***IMPORTANT**: Please read the Application Guidance Document (Guidance) for this permit application prior to completing this application. The Guidance provides specific and important instructions required for completing this application correctly.*

A. PERMIT INFORMATION

Reason for Application: □ NEW CERT

□ RENEW CERT EXISTING CERT # _____

Applicant is: □ Property Owner □ Contractor/Operator

Application is for the following discharge permit (select ONE). See Guidance.

- ○ Construction Dewatering (COG070000)
- ○ Remediation Activities Discharging to Surface Water (COG315000)
- ○ Remediation Activities Discharging to Groundwater (COG316000)

Note: This application is designed for processing each of the three permit types listed above. The division may request additional characterization of the proposed discharge to ensure that the appropriate permit coverage is requested and the appropriate permit certification is issued. The division may deny or change the requested type of discharge permit after review of the submitted application and will notify the applicant of the changes. Coverage under the "Subterranean Dewatering or Well Development" General Permit COG6030000 is not available using this application form.

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B. CONTACT INFORMATION

1. Permittee Information

Organization Formal Name: _____

Permittee Name: the person **authorized to sign and certify** the permit application. This person receives all permit correspondences and is **responsible** for ensuring compliance with the permit.

Responsible Position (Title): _____

Currently Held By (Person): _____

Telephone No: _____

Email address: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

This form must be signed by the permittee to be considered complete. **Per Regulation 61**, in all cases, it shall be signed as follows:

a) In the case of corporations, by a responsible corporate officer. For the purposes of this section, the responsible corporate officer is responsible for the overall operation of the facility from which the discharge described in the application originates.
b) In the case of a partnership, by a general partner.
c) In the case of a sole proprietorship, by the proprietor.
d) In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

2. DMR Cognizant Official (i.e. authorized agent) the person or position authorized to sign and certify reports required by permits including Discharge Monitoring Reports [DMR's], Annual Reports, Compliance Schedule submittals, and other information requested by the division. The division will transmit pre-printed DMR's to this person. If more than one, please add additional pages.

□ Same as 1) Permittee

Responsible Position (Title): _____

Currently Held By (Person): _____

Telephone No: _____

Email address: _____

Organization: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

Per Regulation 61: All reports required by permits, and other information requested by the Division shall be signed by the permittee or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a) The authorization is made in writing by the permittee
b) The authorization specifies either an individual or **a position having responsibility for the overall operation of the regulated facility or activity** such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position)
c) Submitted in writing to the Division

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B. CONTACT INFORMATION (cont.)

3. Site/Local Contact (contact for questions relating to the facility & discharge authorized by this permit.)

□ Same as 1) Permittee

Responsible Position (Title): _____

Currently Held By (Person): _____

Telephone No: _____

Email address: _____

Organization: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

4. Operator in Responsible Charge Required for Groundwater Remediation COG315000 or COG316000

□ Same as 1) Permittee □ Same as 3) Site/ Local Contact

**Note: Where the division determines that coverage under the construction dewatering permit is appropriate, an ORC is not required.*

Operator Number _____ Legal Name: _____

Telephone No: _____Email address: _____

Company: _____

5. Billing Contact □ Same as 1) Permittee

Responsible Position (Title): _____

Currently Held By (Person): _____

Telephone No: _____

Email address: _____

Organization: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

6. Other Contact Types (check below) Add pages if necessary:

Responsible Position (Title): _____

Currently Held By (Person): _____

Telephone No: _____

Email address: _____

Organization: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

□ Environmental Contact
□ Facility Inspection Contact
□ Consultant
□ Compliance Contact
□ Property Owner
□ Other _____

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C. PERMITTED FACILITY INFORMATION

Facility or Project Name _____

Street Address (or cross streets) _____

City_____ Colorado, Zip Code _____

County _____

Type of Facility Ownership

□ City Government □ Corporation □ Private □ Municipal or Water District

□ State Government □ Mixed Ownership _____

Facility or Project Latitude/Longitude — List the latitude and longitude of the excavation resulting in the discharge(s). If the exact excavation location(s) are not known, list the latitude and longitude of the center point of the construction project. If using the center point, be sure to specify that it is the center point of construction activity.

001A Latitude _____. _____ Longitude _____. _____ (e.g., 39.703°, 104.933°')
degrees (to 6 decimal places) degrees (to 6 decimal places)

Horizontal Collection Method: □ GPS Unspecified □ Interpolation Map – Map Scale Number_____
Reference Point: □ Project/Facility Entrance □ Project/Facility Center/Centroid

Horizontal Reference Datum: _____

Standard Industrial Classification (SIC) Code(s) for this FACILITY (include up to 4, in order of importance)

1_____ 2_____3_____4_____

D. PROJECT DESCRIPTION

D.1. Description of Activity:

a) Provide a brief overview of the project and dewatering activity (e.g., highway, bridge and tunnel construction, storm drain expansion, etc.).

b) Is the dewatering and discharge in-stream? (The dewatering operation is considered in-stream where the dewatering activity is conducted within approximately the ordinary high water mark of the stream and/or on the bank of the stream and the discharge is back to the same water body.)

□ Yes * □ No

**If yes, you must provide a description of how your project meets this definition in the box below. If no des cription is provided, the work will not be considered in-stream. Please note that in-stream work activities may also require a separate federal Clean Water Act Section 404 Permit and Colorado 401 Certification.*

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c) Does the activity involve work on or near existing sanitary sewer lines or septic systems?
□ Yes □ No

D.2 Description of Discharge:

a) Is the discharge to a ditch or storm sewer system? □ Yes* □ No
**If yes, the applicant must contact the owner of the ditch or storm sewer system prior to discharging to address any local ordinances and to determine whether additional requirements will be imposed by the owner.*

b) Is the discharge to an impoundment? □ Yes* □ No
**If yes, note that discharge of contaminated groundwater to impoundments are regulated by the Solid Waste Program in the Hazardous Materials and Waste Management Division (HMWMD), and cannot be covered under either the Construction Dewatering or the Remediation Activities Discharging to Surface Water or Groundwater permits.*

c) Discharge Frequency and Duration:

- Estimated discharge start date: _____
- Estimated discharge duration: Years _____ Months _____ Days _____
- Will the permit coverage be transferred after construction is completed? Yes____ No ____

d) Description of Best Management Practices:

Provide a narrative description of the type(s) of treatment used for each outfall in the box below.

D.3 Discharge Outfalls Limit 20 outfalls:

- Total number of **defined** outfalls requested: _____
- Total number of **undefined** outfalls requested:_____ (allowable for construction dewatering only)
- Complete Table 2a (for discharges to surface water) and/or 2b (for discharges to land with percolation to groundwater) to identify your defined and undefined outfall locations. Attach additional pages as necessary.

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Table 2a – Requested Outfalls for Discharges to Surface Water (Discharges that may reach surface water through direct discharge or through a conveyance such as a ditch or a storm sewer system)				
OUTFALL NUMBER[1]	**NAME OF RECEIVING STREAM(S)** (e.g., Cherry Creek, Boulder Creek, Arkansas River)	**ESTIMATED MAXIMUM FLOW RATE**[2] **(gpm)**	**DESCRIPTION OF DISCHARGE LOCATION**[3] (e.g., Discharge enters storm sewer located at the corner of Speer and 8th Ave. with flow to Cherry Creek)	**LATITUDE/LONGITUDE OF EACH DISCHARGE OUTFALL**
Defined Discharges to Surface Water				
001-A				
002-A				
003-A				
004-A				
Undefined Discharges to Surface Water *(Available for construction dewatering only) (Provide **estimated** lat/long only for undefined outfalls)*				
001-AU				
002-AU				
003-AU				
004-AU				

1 Identify up to 20 defined or undefined outfalls (undefined for construction dewatering only). Use additional pages as necessary.
2 For construction dewatering the maximum flow limit will be equal to twice the estimated maximum flow rate provided in the permit application. For groundwater remediation the 30-day average flow limit will be based on the design capacity of the treatment as provided in the permit application.
3 The discharge location is the point where effluent sampling will occur. This location must be at a point after treatment and before the effluent joins or is diluted by any other waste stream, body of water, or substance. If the discharge is to a ditch or storm sewer system, include the name of the ultimate receiving waters where the ditch or storm sewer discharges.

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Table 2b - Requested Outfalls for Discharges to Land with the Potential to Percolate to Groundwater (These discharges do not have the potential to reach surface water either directly or through a conveyance.)			
OUTFALL NUMBER[1]	**ESTIMATED MAXIMUM FLOW RATE**[2] **(gpm)**	**DESCRIPTION OF DISCHARGE LOCATION**[3] (e.g., Discharge to a field south of project site and East of I-25)	**LATITUDE/LONGITUDE OF EACH DISCHARGE OUTFALL**
Defined Discharges to Land with Potential Percolation to Groundwater			
G001-A			
G002-A			
G003-A			
G004-A			
Undefined Discharges to Land with Potential Percolation to Groundwater *(Available for construction dewatering only) (Provide **estimated** lat/long only for undefined outfalls)*			
G001-AU			
G002-AU			
G003-AU			
G004-AU			

1 Identify up to 20 defined or undefined outfalls (undefined for construction dewatering only). Use additional pages as necessary.
2 For construction dewatering the maximum flow limit will be equal to twice the estimated maximum rate flow rate provided in the permit application. For groundwater remediation the 30-day average flow limit will be based on the design capacity of the treatment as provided in the permit application.
3 The discharge location is the point where effluent sampling will occur. This location must be at a point after treatment and before the effluent joins or is diluted by any other waste stream, body of water, or substance.

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E. ADDITIONAL INFORMATION

E.1 Nearby Sources of Potential Groundwater Contamination:

a) Has the proposed dewatering area been reviewed for possible groundwater contamination, such as plumes from leaking underground storage tanks (LUSTs), hazardous waste sites, or additional sources other than what is normally encountered at excavation and construction sites? *Applicants are expected to exercise due diligence in evaluating their project sites prior to applying for a discharge permit.*

□ Yes □ No

b) Is an open LUST located within **one-half mile** of the site?

□ Yes* □ No

**If yes, BTEX analytical data for a source water sample representative of the proposed discharge at the site must be included with the permit application. Failure to include this data may result in delays in processing the permit application until such data is submitted to the Division. See Guidance.*

c) Is a Superfund site or National Priorities List (NLP) site located within **one mile** of the site?

□ Yes* □ No

**If yes, analytical data for all parameters shown in Table 1 of this application (or an alternate list of constituents approved by the division) for a source water sample representative of the proposed discharge must be included with the permit application. Failure to include this data may result in delays in processing the permit application until such data is submitted to the Division. See Guidance.*

d) Is any other (non-LUST, non-Superfund, non-NPL site) known source of contamination, such as a Voluntary Cleanup (VCUP), Environmental Covenant, or open Correct Action site, located within **one-half mile** of the site?

□ Yes* □ No

**If yes, analytical data for all parameters shown in Table 1 of this application (or an alternate list of constituents approved by the division) for a source water sample representative of the proposed discharge must be included with the permit application. Failure to include this data may result in delays in processing the permit application until such data is submitted to the Division. See Guidance.*

e) If known sources of contamination are located near the site, provide an overview of the source and nature of contamination including:

- The nature of the contamination of the groundwater, alluvial water, stormwater, and/or surface water (the source water) for which treatment and/or remedial activities will occur,
- The primary industrial activities which resulted in the source water contamination,
- The source of the contamination (pipes, leaking underground storage tank, up gradient sources, etc.) or state "unknown."

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f) For contaminated discharges (remediation), provide a narrative description of the type(s) of treatment proposed for use at each identified outfall.

E.2 Chemical Additions

List any chemical additives or other materials to be used in the water or to treat water prior to discharge. Include the Material Safety Data Sheet (MSDS) for each chemical with the application.

CHEMICAL NAME	MANUFACTURER	PURPOSE	DOSAGE

E.3 Site Maps and Schematics

Are required maps and schematics attached? □ Yes
□ No-Application cannot be processed without required maps

- ✓ **A Location Map for Defined Outfalls** – Application must include a location map that shows the location of the project/facility, the location of the defined discharge point(s)/outfalls, and any receiving water(s). A north arrow must be shown. **This map must be on paper that can be folded to 8 ½ x 11 inches.**

- ✓ **A Legible Site Sketch** must be submitted that includes detailed site boundary information including street names or mile markers, the location of dewatering or remediation activities, all defined discharge points, and sampling locations. For undefined discharges (allowed for construction dewatering projects only), the site sketch must include the limits of the construction site boundary and the location of potential receiving waters. **This map must be on paper that can be folded to 8 ½ x 11 inches.**

- ✓ **Does the applicant have a Stormwater Permit for Construction Activities?** □ YES □ NO □ PENDING
If Yes, Stormwater Construction Permit Number: COR-_____

WATER RIGHTS

The State Engineers Office (SEO) has indicated that any discharge that does not return water directly to surface waters (i.e. land application, rapid infiltration basins, etc.) has the potential for material injury to a water right. As a result, the SEO needs to determine that material injury to a water right will not occur from such activities. To make this judgment, the SEO requests that a copy of all documentation demonstrating that the requirements of Colorado water law have been met, be submitted to their office for review. The submittal should be made as soon as possible to the following address:

Colorado Division of Water Resources ● 1313 Sherman Street, Room 818 ● Denver, Colorado 80203

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Should there be any questions on the issue of water rights; the SEO can be contacted at (303) 866-3581. It is important to understand that any CDPS permit issued by the division does not constitute a water right. Issuance of a CDPS permit does not negate the need to also have the necessary water rights in place. It is also important to understand that even if the activity has an existing CDPS permit, there is no guarantee that the proper water rights are in place.

F. REQUIRED CERTIFICATION SIGNATURE [Reg 61.4(1)(h)]

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature (Legally Responsible Party (Page 2 item 1) _____

Date _____

Name (printed) _____Title_____

This form must be signed by the permittee to be considered complete. **Per Regulation 61**, in all cases, it shall be signed as follows:

a) In the case of corporations, by a responsible corporate officer. For the purposes of this section, the responsible corporate officer is responsible for the overall operation of the facility from which the discharge described in the application originates.
b) In the case of a partnership, by a general partner.
c) In the case of a sole proprietorship, by the proprietor.
d) In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

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ATTACHMENT 1
Please Submit the Laboratory Data Package for any Required Analysis with the Permit Application
(See Important Table Notes)

Required Water Quality Data			
Metals	**PQL**	**Metals**	**PQL**
Aluminum-Trec	50 ug/l	Lead-PD	1 ug/l
Antimony-Trec	NA	Manganese-PD	2 ug/l
Arsenic-Trec	1 ug/l	Manganese-Diss	2 ug/l
Arsenic-PD	1 ug/l	Molybdenum-Trec	NA
Barium-Trec	5 ug/l	Nickel-Trec	50 ug/l
Beryllium-Trec	1 ug/l	Nickel-PD	50 ug/l
Cadmium-Trec	1 ug/l	Selenium-Trec	1 ug/l
Cadmium-PD	1 ug/l	Selenium-PD	1 ug/l
Chromium III-Trec	20 ug/l	Silver-Trec	0.5 ug/l
Chromium III-PD	20 ug/l	Silver-PD	0.5 ug/l
Chromium VI-Trec	20 ug/l	Thallium-Trec	1 ug/l
Chromium VI-Diss	20 ug/l	Thallium-PD	1 ug/l
Copper-Trec and PD	5 ug/l	Uranium-PD	1 ug/l
Iron-Trec	10 ug/l	Uranium-Trec	1 ug/l
Iron-Diss	10 ug/l	Zinc-Trec	10 ug/l
Lead-Trec	1 ug/l	Zinc-PD	10 ug/l
Volatiles	**PQL**	**Volatiles**	**PQL**
acrolein	15 ug/l	ethylbenzene*	75 ug/l
benzene*	3 ug/l	methyl bromide	5 ug/l
bromoform	3 ug/l	methyl chloride	4.5 ug/l
carbon tetrachloride	3 ug/l	1,1,2,2-tetrachloroethane	2 ug/l
chlorobenzene	60 ug/l	tetrachloroethylene	2.3 ug/l
chlorodibromomethane	3 ug/l	toluene*	60 ug/l
2-chloroethylvinyl ether	NA	1,2-trans-dichloroethylene	TBD
chloroform	3 ug/l	1,1,1-trichloroethane	5 ug/l
1,2-dichlorethane	3 ug/l	1,1,2-trichloroethane	2.0 ug/l
1,1-dichlorethylene	5 ug/l	trichloroethylene	2.5 ug/l
1,2-dichlorpropane	2 ug/l	vinyl chloride	3 ug/l
1,3-dichlorpropylene	TBD	1,4-Dioxane	TBD
Semi-Volatile Organic Compounds	**PQL**	**Semi-Volatile Organic Compounds**	**PQL**
acenaphthene	20 ug/l	1,2-diphenylhydrazine (as azobenzene)	TBD
acenaphthylene	30 ug/l	fluorene	20 ug/l
anthracene	20 ug/l	fluoranthene	25 ug/l
benzidine	170 ug/l	hexachlorobenzene	16 ug/l
benzo(a)anthracene	12 ug/l	hexachlorobutadiene	9 ug/l
benzo(a)pyrene	20 ug/l	hexachlorcyclopentadiene	50 ug/l
3,4-benzofluoranthene	25 ug/l	hexachloroethane	16 ug/l
benzo(ghi)perylene	20 ug/l	indeno(1,2,3-cd)pyrene	20 ug/l
benzo(k)fluoranthene	25 ug/l	isophorone	25 ug/l
bis(2-chloroethyl)ether	15 ug/l	naphthalene	20 ug/l
bis(2-chloroisopropyl)ether	NA	nitrobenzene	19 ug/l
bis(2-ethylhexyl)phthalate	25 ug/l	N-nitrosodimethylamine	30 ug/l

Semi-Volatile Organic Compounds	PQL	Semi-Volatile Organic Compounds	PQL
Butyl benzyl phthalate	25 ug/l	N-nitrosodi-n-propylamine	30 ug/l
2-chloronaphthalene	20 ug/l	N-nitrosodiphenylamine	19 ug/l
chrysene	18 ug/l	pyrene	10 ug/l
dibenzo(a,h)anthracene	20 ug/l	1,2,4-trichlorobenzene	20 ug/l
1,2-dichlorobenzene	2.5 ug/l	2-chlorophenol	35 ug/l
1,3-dichlorobenzene	2.5 ug/l	2,4-dichlorophenol	30 ug/l
1,4-dichlorobenzene	3.5 ug/l	2,4,-dimethylphenol	30 ug/l
3,3-dichlorobenzidine	18 ug/l	4,6-dinitro-o-cresol	17 ug/l
diethyl phthalate	20 ug/l	2,4-dinitrophenol	100 ug/l
dimethyl phthalate	20 ug/l	4-nitrophenol	25 ug/l
di-n-butyl phthalate	25 ug/l	pentachorophenol	36 ug/l
2,4-dinitrotoluene	100 ug/l	phenol	15 ug/l
2,6-dinitrotoluene	20 ug/l	2,4,6-trichlorophenol	25 ug/l
xylene*	TBD	1,4-Dioxane	TBD

**BTEX = Benzene, Toluene, Ethylbenzene, and Xylene*

Important table notes:

1) Please refer to the permit application Guidance to determine whether analytical data is required with the permit application, and if so, what specific type of data is required.

2) Abbreviations: **Trec** = Total Recoverable; **PD** = Potentially Dissolved, **Diss** = Dissolved, **PQL** = Practical Quantitation Limit

3) Parameter names match the names as they appear in the general permit. The parameter may have a different name in some regulations or the PQL guidance.

4) The division may require analytical data for additional parameters where the project site is located in close proximity to potential sources of contamination for parameters not include in this Attachment 1, including but not limited to pesticide, PCB, radionuclide contamination.

5) Benzene, toluene, ethylbenzene, and xylene are highlighted to show that they are often grouped as "BTEX" and that data for BTEX is more commonly required than data for other parameters.

6) Applicants applying under the General Permit for Remediation Activities Discharging to Groundwater (COG316000) are encouraged to contact the division prior to sample collection to ensure that the correct metal speciation is included in the sample analysis.

APPLICATION GUIDANCE DOCUMENT

COLORADO DISCHARGE PERMIT SYSTEM (CDPS) General Permits:

- **Construction Dewatering** (COG070000)
- **Remediation Activities Discharging To Surface Water** (COG315000), or
- **Remediation Activities Discharging To Groundwater** (COG316000)

Contents

This guidance is designed to assist in completing the application for processing each of the three permit types listed above. The Water Quality Control Division may request additional information and characterization of the proposed discharge to ensure that the appropriate permit coverage is requested and the appropriate permit certification is issued. The division may deny or change the requested type of discharge permit after review of the submitted application and will notify the applicant of the changes. Please note:

- Coverage under the "Subterranean Dewatering or Well Development" General Permit (COG6030000) is not available using this permit application form.
- The discharge of contaminated groundwater to an impoundment is regulated by the Solid Waste Program in the Hazardous Materials and Waste Management Division, and also cannot be covered under any of the above permits.
- The discharge of uncontaminated groundwater to land may be discharged under the division's *Low Risk Discharge Guidance: Discharges of Uncontaminated Groundwater to Land* as an alternative to obtaining coverage to discharge under this permit. The low risk policy is available for download at www.coloradowaterpermits.com.
- As provided in General Permit COR030000, the discharge of uncontaminated groundwater to land may also be discharged under an exisiting construction stormwater permit where permit conditions are met.

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A. PERMIT INFORMATION

Reason for Application: Indicate whether this is an application for a new certification or if you are renewing an existing certification (as required prior to the expiration date of an existing general permit or certification). If you are renewing an existing certification, please provide the existing permit certification number.

Applicant is: Indicate the entity that will hold (be legally responsible for) the permit.

Application is for the following discharge permit (select ONE): In order to determine whether your project qualifies for coverage under a construction dewatering general permit (COG070000) or requires a remediation general permit (COG315000 or COG316000), you must determine whether there are known sources of groundwater contamination located in the vicinity of your project site. Where nearby sources of groundwater contaminations are identified, you will need to determine whether your project has the potential to draw-in contaminated groundwater. The best way to make this determination is to use the criteria in Table 1 below to determine if your project site is located in the vicinity of potential ground water contamination. If so, collect a sample of groundwater from your project site (i.e., water that is representative of the water you propose to discharge). Then, use Table 1 to determine what parameters to include in your analysis, have it analyzed for those parameters described, and submit the data with your permit application.

Table 1: Locations of Potential Groundwater Contamination

Is Your Project Site Located in the Vicinity of Potential Groundwater Contamination? [1]	
Project Location Relative to a Source of Potential Groundwater Contamination	**Analytical Data Likely to be Required with the Permit Application**
Within **0.5 mile** of an open Leaking Underground Storage Tank (LUST) site *(Note that closed LUSTs are assumed to pose a low risk for potential groundwater contamination and, therefore, the submission of analytical data based on proximity to a closed LUST is not required)*	BTEX only
Within **0.5 mile** of an open Voluntary Cleanup (VCUP) site	All parameters listed in Attachment 1 of the permit application (or an alternate list approved by the division)[2]
Within **0.5 mile** of an Environmental Covenant	
Within **0.5 mile** of an open Resource Conservation Recovery Act (RCRA) Corrective Action Site	
Within **1.0 mile** or more of a Superfund site or National Priorities List (NPL) site with associated groundwater contamination	

1 This table provides examples of sources of contamination. Other types and sources of potential groundwater contamination may exist.

2 Analyze a groundwater sample that is representative of the water you propose to discharge for the parameters of concern for the project areas (i.e., total, dissolved, potentially dissolved). This may be a subset of Attachment 1 in the permit application. Note this subset list must be approved by the division. See Important Notes in Appendix A at the end of this guidance for more information on this topic.

Information regarding the locations of the various types of contaminated sites (LUST, VCUP, Environmental Covenants, RCRA Corrective Action, or Superfund) may be found in Appendix B of this document.

Once you have determined if your project site is located in the vicinity of potential groundwater contamination, use the **flowchart** on the following page to help determine the appropriate permit coverage for your discharge.

Table 2 below supplements the selection process by providing possible groundwater contamination scenarios and general permit descriptions and coverage. Select the one type of permit coverage most appropriate for this project. Please note that one application is intended to cover one project and one type of permit. Where multiple projects or types of permits are required, you must submit an appropriate number of permit applications.

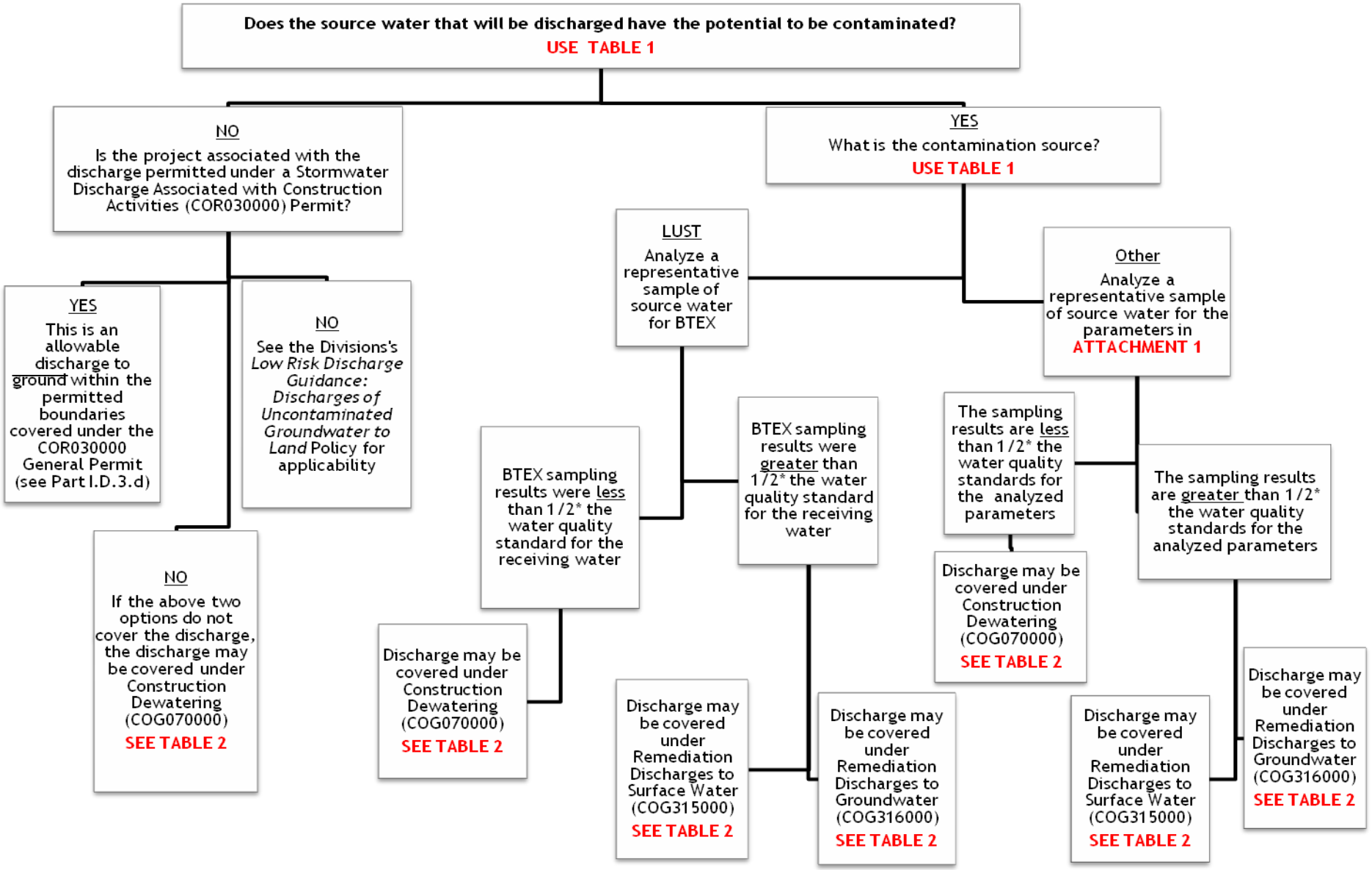
Table 2: General Permit Descriptions and Information[1]

	Construction Dewatering (COG70000)	**Remediation Activities Discharging to Surface Waters (COG315000)**	**Remediation Activities Discharging to Ground Water (COG316000)**
Covered Discharges	Uncontaminated source water OR Contaminated (by BTEX only) source water[2] that has come into contact with construction activities	Discharges from treatment and/or remedial activities of contaminated groundwater, alluvial water, stormwater, and/or surface water (which may be associated with construction activities)	Discharges from treatment and/or remedial activities of contaminated groundwater, alluvial water, stormwater, and/or surface water (which may be associated with construction activities)
Discharge Location	To surface water and/or to land with potential percolation to groundwater	To surface water or land with potential percolation to groundwater hydrologically connected to surface water	To land with the potential to percolate to groundwater not hydrologically connected to surface water
Applicant Requirements	BTEX[3] Analysis (if within one half mile of an open LUST)	Influent Screening[4]	Influent Screening
Division Authorization	Discharges under this permit will not be authorized if pollutants may be present in the source water in concentration greater than a numeric water quality standard of the receiving water	Discharges under this permit may be authorized if pollutants may be present in the source water in concentration greater than a numeric water quality standard of the receiving water	Discharges under this permit may be authorized if pollutants may be present in the source water in concentration greater than a numeric water quality standard of the receiving water

1 The Division may deny or change the requested type of discharge permit after review of the submitted application and will notify the applicant of the changes.
2 Source Water: Groundwater, surface water, alluvial water, or stormwater mixed with groundwater and/or surface water
3 BTEX: Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) are common pollutants found in petroleum based products
4 See Attachment 1 in the permit application packet

Additional information and resources for identification of contaminated groundwater and sampling procedures can be found in this guidance document:

- APPENDIX A: Information for Completing Analyticals Required
- APPENDIX B: Resources for Determining Groundwater Contamination Potential
- APPENDIX C: Division Determination Using the Application Information and Data



*One-half the water quality standard is a general comparison. This may vary on a case by case basis resulting in different permit coverage than what is stated above.

B. CONTACT INFORMATION

Provide the required contact information. Note that the person listed as the *Permittee* (Responsible Position) must also be the person that signs and certifies the permit application. This person receives all permit correspondences and is legally responsible for compliance with the permit.

Note that the person listed as the *DMR Cognizant Official* will receive all pre-printed discharge monitoring report (DMR) forms associated with the permit.

C. PERMITTED FACILITY INFORMATION

Provide the required facility information.

Facility or Project Latitude/Longitude: The following definitions are based on text from the EPA Data Standard.

- Horizontal Collection Method: Describes the method used to determine the latitude and longitude coordinates for a point on the earth. This specifies what type of method or device was used to identify the latitude and longitude, e.g., a Global Positioning System (GPS) device, Google Earth, an address, an intersection, a census block centroid, etc. The key is that the horizontal collection method determines how the coordinates were collected, not where.

- Reference Point: The text that identifies the place for which the geographic coordinates were established. This specifies the location at the place where the coordinates were taken, e.g., entrance to a facility, center of a facility, etc. The key is that the reference point determines where the coordinates were collected, not how.

- Horizontal Reference Datum: The horizontal reference datum is the coordinate reference system to which the latitude/longitude data relate. Per EPA's *Latitude/Longitude Data Standard*, there are three possible values associated with horizontal reference datum. Horizontal reference datum possible responses are as follows:

    - North American Datum of 1927 (**NAD27**): If you are reporting a location using a USGS 7.5-minute map, NAD27 is your default datum.

    - North American Datum of 1983 (**NAD83**): NAD83 updated NAD27 with current measurements using radio astronomy and satellite observations. When the USGS began publishing digital data, the NAD83 was used, which provided a more accurate representation of the earth's shape and a more accurate depiction of the location of objects on the earth.

    - World Geodetic System of 1984 (**WGS84**): If you used a GPS or Google Earth to calculate your latitude/longitude coordinates, WGS84 is the default datum.

Standard Industrial Classification (SIC) Code(s) for this Facility: Standard Industrial Classification (SIC) codes are four digit numerical codes assigned by the U.S. government to business establishments to identify the primary business of the establishment. SIC codes can be obtained at: https://www.osha.gov/pls/imis/sicsearch.html. The most common SIC code for businesses conducting construction-related work is **1799: Special Trade Contractors, Not Elsewhere Classified.** This includes dewatering contractors.

D. PROJECT DESCRIPTION

D.1 Description of Activity and **D.2 Description of Discharge**: Provide thorough and detailed responses to the questions in these sections in order to facilitate and expedite the review and processing of your application.

Note that "in-stream" work is:

- Conducted within approximately the ordinary high water mark* of the stream, and/or
- Conducted on the bank of the stream, and
- potentially including subsurface flow to the stream.

* "The term *ordinary high water mark* means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area."

(Taken directly from USACE Regulatory Guidance Letter "Ordinary High Water Mark Identification" dated 12/07/2005)

D.3 Discharge Outfalls: Discharge "outfalls" refer to the physical location where the discharge occurs. This discharge location may be different from the source water location. For example, you may dewater your project site by pumping water from the excavation (the source) to the nearby stream (the outfall). This portion of the permit application requires information regarding your outfall location(s).

What is a defined outfall versus an undefined outfall?

The permit application requires that you specify whether the outfall is defined or undefined.

- A defined outfall has a known location, specified by latitude and longitude at the time of permit application. Where defined outfalls are requested, the division will mail DMRs that include the specified location information. Permittees often find this information helpful in managing their DMRs, and submitting the correct DMR form for the outfall location.
- An undefined outfall has an unknown location at the time of permit application. Undefined outfalls are only available for construction dewatering (COG07000, Part I.B.1). In this case the specific location for each discharge is established by the permittee at the time the discharge commences, and may not be changed once established. Permittees are responsible for making sure that the same DMR (for example the DMR labeled "Outfall 001A") is always used for the same outfall sampling location. A single DMR cannot be used for multiple locations in the field. Undefined outfalls provide flexibility during construction activities; however, they may be difficult to manage and the most stringent water quality standards for all potentially impacted streams are applied to all discharge outfalls.

What is the maximum number of outfalls that I can request?

You are allowed to request up to 20 outfalls in one permit application. For construction dewatering, which may include undefined outfalls, the outfall limit applies to the total number of undefined and defined outfalls. Undefined outfalls are only available for construction dewatering. Where your project requires additional outfalls, you may request a modification to your permit certification to add additional outfalls.

Is this a discharge to surface water or to land with the potential to percolate to groundwater?

The permit application requires that you specify whether the outfall is a discharge is to surface water or to land with the potential to percolate to ground water.

- A discharge to surface water can occur directly or through a conveyance such as a ditch or a storm sewer system.
- A discharge to groundwater occurs through land application and/or through discharge to a sediment basin with percolation to groundwater.
- If your discharge is to a sediment basin and the basin overtops, the division may determine that your discharge is to both surface water and groundwater, and will include appropriate permit limitations for both surface water and groundwater in your permit certification.

How do I estimate the maximum flowrate?

The estimated maximum discharge flow rate must be provided in order for the division to process the permit application. In order to estimate your maximum flow rate, you might consider the maximum capacity of the pumps at your site and the total number of pumps that can be operating together at one excavation. For stream diversions, you might estimate the maximum flow rate of the stream around your work activity. For remediation projects where treatment is in place, estimate the maximum flow rate appropriate for your treatment system.

The Division will apply your flow information in your permit certification as follows:

- For construction dewatering, the acute flow limit (i.e., maximum flow limitation) will be equal to twice the estimated maximum rate flow rate provided in the permit application.
- For groundwater remediation, both the acute flow limit (i.e., maximum flow limitation) and the chronic flow limit (i.e., 30-day average flow limitation) will be based on the design capacity of the treatment as provided in the permit application.

Where will the sampling occur?

Per the general permit, discharge points shall be designed or modified so that a sample of the effluent can be obtained at a point after the final treatment process and prior to discharge to state waters. All samples must be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points cannot be changed without notification to and approval by the division. The permittee must provide access to the division to sample the discharge at these points.

E. ADDITIONAL INFORMATION

E.1 Nearby Sources of Potential Groundwater Contamination: In this portion of the application, you are required to document the results of your due diligence efforts, including whether or not you identified potential sources of groundwater contamination in the vicinity of your project. Information to help you complete this portion of the application was provided in the flowchart and tables above, as well as in Appendix A-C of this guidance document.

E.2 Chemical Additions: List any chemicals to be used in, or applied to, waters that may be discharged. Include a copy of each chemical's current Material Safety Data Sheet. All chemicals used in waters that may be discharged must be approved by the division.

E.3 Site Maps and Schematics: The complete application must include these maps and site sketches.

WATER RIGHTS

The permittee is responsible for contacting the State Engineers Office as appropriate. Issuance of a CDPS permit does not negate the need to also have the necessary water rights in place. It is also important to understand that even if the activity has an existing CDPS permit, there is no guarantee that the proper water rights are in place.

F. REQUIRED CERTIFICATION SIGNATURE [Reg. 61.4(1)(h)]

The application must be signed by the responsible party in order to be processed by the Division. An original (wet) signature is required on the permit application submitted to the division.

APPENDIX A: Information for Submitting Required Data

A list of required parameters to be sampled for is found in Attachment 1 of the permit application. (See important notes.)

Unless otherwise indicated by the division, all influent screening must adhere to the following stipulations:

- Metals analyses must be performed for the analytical form (total recoverable, potentially dissolved, and/or dissolved) identified in Attachment 1 of the permit application.
- Analytical methods for metals must measure below or equal to the practical quantitation limit (PQL) identified in Attachment 1 of the permit application.
- Analytical methods and PQLs selected for all parameters must be in accordance with the criteria established in the permit application.
- The sample collected must be representative of the source water.

IMPORTANT NOTES:

- **Alternate List of Parameters:** Where the applicant can identify the parameters associated with the source of potential groundwater contamination, the applicant may contact the division to request approval to analyze only for those parameters, and to submit data for only those parameters with the permit application.
- In lieu of submitting analytical data, you may choose to demonstrate that your site is not likely to be impacted by nearby sources of contamination by submitting other relevant information with your permit application for review and consideration by the division. For example, you may submit information regarding the geology and hydrogeology of the site, groundwater flow direction, or historic groundwater data. This information must be accompanied by a narrative discussion of how and why this information shows that groundwater at your project site is not likely to be contaminated. The division will review this information, and determine if it is sufficient to demonstrate that groundwater at the site is not likely to be contaminated. Where the division finds the information to be insufficient, the division will require additional data or information, potentially delaying the processing of the permit.
- Applicants applying under the General Permit for Remediation Activities Discharging to Groundwater (COG316000) are encouraged to contact the division prior to sample collection to ensure that the correct metal speciation is included in the sample analysis.

APPENDIX B: Resources for Determining Groundwater Contamination Potential

The following resources are available for determining if contaminated groundwater may be located near your project site:

- **Leaking Underground Storage Tanks (LUSTs):** Oil and Public Safety (OPS) COSTIS database (Storage Tank Database). Search for events by city, county, or zip code on the OPS website.
  - http://costis.cdle.state.co.us/home.asp.

- **Voluntary Cleanup Sites (VCUPs):** The CDPHE Hazardous Materials and Waste Management Division (HMWMD) maintains a list of VCUPs by County. Visit the HMWMD website, and select the "Voluntary Cleanup Sites Grouped by County" list at the top of the page.
  - https://www.colorado.gov/pacific/cdphe/voluntary-cleanup

- **Environmental Covenants:** Environmental Covenant Sites are listed on the CDPHE HMWMD website. The county the site is located in and a map of the contaminated area are provided on this webpage.
  - https://www.colorado.gov/pacific/cdphe/hmcovenants.

- **Superfund Sites:** The CDPHE HMWMD maintains a list of active Superfund sites on its website. Select the "Active Superfund Sites" link to view a list of sites and site addresses. The division may require data even if your site is greater than one-mile from a Superfund site, based on the nature and extent of contamination at these sites.
  https://www.colorado.gov/pacific/cdphe/superfund-sites
- **RCRA Corrective Action Sites:** The CDPHE HMWMD can provide information on RCRA sites in Colorado that are undergoing or potentially undergoing ground water remediation. You may also call HMWMD's Customer Technical Assistance Line at 303-692-3320.
  - http://epa.gov/waste/hazard/correctiveaction/index.htm
  - www.epa.gov/myenvironment:
    - 1: enter a location and Click "go"
    - 2. Click on "MyLand"
    - 3. Click on "Cleanups in my Community"
    - 4. Zoom in to your location or enter a location and view the RCRA corrective action sites in your area.

- **National Priorities List (NPL) sites:**
  - http://www.epa.gov/superfund/sites/npl/

APPENDIX C: Division Determination Using the Application Information and Data

As a general rule of thumb, the division will make an initial determination of appropriate permit coverage based largely on the proximity of your project site to known sources of contamination and the potential to draw-in the contaminated groundwater. The division will then review analytical data and information submitted with the application, along with any additional information available to the division, to determine whether your project has the potential to draw-in contaminated groundwater and to verify that you have selected the correct permit coverage for your project. Where analytical data is included with the permit application, the division will conservatively compare the maximum detected concentration of each detected constituent to one-half the applicable water quantity standard to determine if there is reasonable potential for a pollutant in the source water to exceed a water quality standard of the receiving water.

- For project sites where no known potential sources of contamination are located within one mile of the project site AND the permit applicant has no other information which would indicate that the discharge may be contaminated:
    - No source water analytical data is required with the permit application.
        - These projects will typically be permitted under *Construction Dewatering (COG070000)*
- For project sites where known potential sources of contamination **only** BTEX are located within one-half mile of the project site:
    - BTEX data is required with the application, unless the applicant can provide other information indicating there is no reasonable potential for BTEX to contribute pollutants to the source water.
        - Where the data shows that the source water does not contain concentrations of BTEX greater than ½ the water quality standards of the receiving water, the project may be permitted under *Construction Dewatering (COG070000)*.
        - Where the data show that the source water does contain concentrations of BTEX greater than ½ the water quality standards of the receiving water, the project may be permitted under *Remediation Activities Discharging to Surface Water (COG315000)* or *Remediation Activities Discharging to Groundwater (COG316000),* or an individual permit as applicable.
- For project sites where other known potential sources of contamination are located within one mile of the project site:
    - Pre-screening data (see Attachment 1 of the application) is required, unless the applicant can provide other information indicating that there is no reasonable potential for the contamination to contribute pollutants to the source water being discharged.
        - Where the data show that the source water does contain concentrations of potential pollutants from the contamination source that are greater than ½ the water quality standards of the receiving water, the project may be permitted under *Remediation Activities Discharging to Surface Water (COG315000)* or *Remediation Activities Discharging to Groundwater (COG316000),* or an individual permit as applicable.

The flowchart in this guidance summarizes the above detailed process used by the division for evaluating data and determining appropriate permit coverage. Note that other factors may be considered outside of these guidelines, resulting in the need for additional information to supplement the permit application.

COLORADO DISCHARGE PERMIT SYSTEM (CDPS)
FACT SHEET TO PERMIT NUMBER COG315000
GENERAL PERMIT FOR DISCHARGES FROM REMEDIATION ACTIVITIES

TABLE OF CONTENTS

I. TYPE OF PERMIT

Master General, NPDES, Surface Water, Fifth Renewal, Statewide

II. SCOPE OF THE GENERAL PERMIT

A. SIC Code: 1799 Special Trade Contractors, Not Elsewhere Classified
1629 Heavy Construction, Not Elsewhere Classified

B. Major Changes from Last Renewal:

The current general permit, which expired on October 31, 2010 and has been administratively extended by the Water Quality Control Division (Division), provides coverage for 25 Facilities with Remediation Activities. This renewed general permit is needed to continue to provide coverage for these established dischargers and for new groundwater remediation facilities that are operating throughout Colorado. Major changes from last renewal include the following:

- Inclusion of requirements to develop, document, and implement a Remediation Discharge Activities Management Plan in accordance with good engineering, hydrologic and pollution control practices to ensure compliance with effluent limitations and other permit conditions.
- Inclusion of a provision that requires dischargers to contain the initial effluent until analyses have confirmed that all numeric effluent limitations have been met. The Division has been including this condition in certifications under the current permit
- Quarterly influent screen for Base, Neutral, Acids, Volatile Organic Compounds, and Metals to detect changes in discharge
- Inclusion of practices required for discharges in exceedance of water quality standards
- Limitations on coverage to exclude discharges to groundwater or to outstanding waters

C. Facilities Covered:

This general permit is to authorize discharges from Remediation Activities to surface waters of the State in Colorado. Only facilities with activities that meet the definition of Remediation Activities are eligible for coverage under the general permit.

Table II-1 lists the 25 entities currently covered under the administratively extended Groundwater Remediation General Permit. The Division has received renewal applications for these 25 facilities.

Table II-1—Inventory of Facilities with Certifications under the Current General Permit

Certification	Facility	Discharge Flow Rate	Receiving Stream(s)
COG315025	*Municipal Service Center*	*001A-16.4 GPM*	*Little Dry Creek, within segment 16c Upper South Platte River Sub-basin*
COG315144	*Blanton Mountain Mart*	*001A-30 GPM*	*Tributary to Illinois River, within segment 4 of the North Platte River Sub-basin*
COG315146	*Hamilton Sundstrand Facility*	*001A-145 GPM* *002A-6.6 GPM*	*Little Dry Creek and Kalcevic Gulch, both within segment 16b of the Clear Creek Sub-basin*
COG315147	*Olde's Texaco Service Facility*	*001A-10 GPM*	*Tributary to Bear Creek, within Segment 1a of the Bear Creek Sub-basin*
COG315157	*RTD Tunnel 16 Groundwater Treatment Facility*	*003A-350 GPM*	*South Platte River, within Segment 14 of the Upper South Platte River Sub-basin*
COG315161	*Dietrich Standard Corporation*	*001A-40 GPM*	*Tributary to Dry Creek, within Segment 6 of the St. Vrain Sub-basin*
COG315165	*12000 W Cedar Dr Lot*	*001A-30 GPM*	*Lakewood Gulch, Segment 16c of the Upper South Platte River Sub-basin*
COG315169	*CDOT Materials Testing Lab*	*001A-1.5 GPM*	*Cherry Creek, Segment 03 of the Cherry Creek Sub-basin*
COG315176	*Raytheon Boulder Facility*	*001A-12 GPM* *002A-36 GPM*	*Both to tributaries to Dry Creek, within Segment 6 of the St. Vrain Sub-basin*
COG315179	*A and W Loveland Quick Trip Lust*	*001A-30 GPM*	*Big Barnes Ditch, within Segment 6 of the Big Thompson River Sub-basin*
COG315180	*Broderick Wood Prod Superfund*	*001A-67 GPM* *001B-67 GPM* *002A-80 GPM*	*Clear Creek, within Segment 15 of the Clear Creek Sub-basin*
COG315182	*BP Service Station 12001*	*001A-10 GPM*	*Clear Creek, within Segment 15 of the Clear Creek Sub-basin*
COG315183	*Former Redfield site*	*001A-40 GPM*	*Unnamed ditch tributary to Goldsmith Gulch, within Segment 4 of the Cherry Creek Sub-basin*
COG315197	*400 E 104 Ave Lot*	*001A-5 GPM*	*Grange Hall Creek-tributary to the South Platte River, within Segment 16c of the Upper South Platte River Sub-*

			basin
COG315198	*Wadsworth 66 Service Station*	*001A-5 GPM*	*Sanderson Gulch-tributary to the South Platte River, within Segment 16c of Upper South Platte River Sub-basin*
COG315210	*Pecos Street Grade Separation*	*001A- 450 GPM* *002A-450 GPM*	*Karen's Pond, tributary to Clear Creek, and directly to Clear Creek, both within Segment 15.*
COG315211	*Residence at 29 St Lot 4*	*001A-30 GPM*	*Boulder Creek, Segment 02b of the Boulder Creek Sub-basin, South Platte River Basin*
COG315215	*Mesa to Skylake Pipeline Project*	*SW 001A-200 GPM (Mobile to surface water)* *GW 001A-200 GPM (Mobile to Groundwater)*	*First Creek, Second Creek and the South Platte River, within segments 15, 16c, and 16d of the Upper South Platte River Sub-basin and* ***Groundwater***
COG315216	*W Main Pipeline Integrity Mgmt Program*	*200 GPM (Mobile)*	*Big Thompson River, within segment 04a of the Big Thompson River Sub-basin and to* ***Groundwater***
COG315217	*Kenwood Outfall*	*001A-100 GPM*	*South Platte River, Segment 15 of the Upper South Platte River Sub-basin*
COG315219	*Dahlia Ponds*	*001A-2,000--4,000 GPM*	*South Platte River, Segment 15 of the Upper South Platte River Sub-basin*
COG315224	*I-25 and Alameda Ave Project*	*001A-350 GPM* *002A-1,500 GPM*	*South Platte River, Segment 14 of the Upper South Platte River Sub-basin*
COG315225	*Denver Union Station*	*001A-1,000 GPM*	*South Platte River, Segment 14 of the Upper South Platte River Sub-basin*
COG315226	*South Platte River - Lower Lakewood Gulch*	*001A-120 GPM*	*South Platte River, Segment 14 of the Upper South Platte River Sub-basin*

D. Limitations on Coverage:

The Division included a limitation of coverage related to having representative data of the contaminated source water in order to characterize the waste stream and to identify all parameters which will require monitoring and/or numeric effluent limitations.

There are some discharges from Remediation Activities that cannot be covered under this general permit and must apply for coverage under another general permit or under an individual permit. These exclusions include discharges from Remediation Activities that:

- include other wastewaters (i.e., domestic wastewaters),
- are land applied or otherwise released to groundwater, or
- are to receiving waters designated as "outstanding waters"

Discharges that include other wastewaters such as domestic wastewaters are excluded on the basis that there may be additional pollutants of concern and other discharge characteristics that were not evaluated in the development of this general permit.

Land application or other discharges to groundwater are excluded from this permit. There are two current facilities with certifications authorizing discharges to groundwater. The Division will work directly with these two facilities to determine the best permitting approach for these discharges.

The Division requires that discharges to outstanding waters be authorized only by an individual permit, since a site specific evaluation is needed to meet the antidegradation requirements of Regulation 31.

E. Application Requirements:

Remediation facilities can apply for coverage under this general permit upon the issuance and effective date of the permit by submitting a complete and accurate application at least 45 days prior to the anticipated discharge. Following review of the application, the Division may request additional information. Upon receipt of the additional information, the Division shall have additional time to issue or deny the authorization to discharge.

Existing facilities with certifications under the administratively extended Groundwater Remediation General Permit (COG-315000) that have submitted renewal applications and qualify for coverage under the new general permit will automatically be transferred. Coverage will be transferred to the new general permit without a lapse of coverage (i.e. discharging without a permit) and without loss of fee payments.

The CDPS general permit for Construction Dewatering activities (COG-070000) authorizes discharges from similar activities as this general permit, but for which Remediation Activities are not conducted. As part of the Division's review of an application for coverage under COG-070000, or based on the availability of new information for facilities with existing coverage, the Division will assess the potential for various sources of contamination to be present in the discharge. Water quality based effluent limits may be required based on a Reasonable Potential Analysis (see Part VI.A.2.g) due to the presence of contaminants in the source water. Coverage under COG-070000 will not be authorized by the Division if remediation activities will be conducted for the discharge based on these water quality based effluent limits. If the applicant wishes to obtain coverage under the Remediation Activities general permit for the discharge, the following information must be submitted to the Division:

- a statement requesting that the information received in the Construction Dewatering application be applied towards the Remediation Activities Permit application,
- source water characterization data, and
- a description of the treatment utilized in order to meet limitations
- additional information as requested by the Division

All information must be submitted by the permit applicant legal contact and signed in accordance with Part I.E.7 of the permit.

III. RECEIVING STREAM

The Division has identified the stream segments to which the facilities with current certifications under the general permit discharge. The Division expects to continue coverage for these facilities under this general permit since the stream standards and designations are consistent with the limitations on coverage in the general

permit (i.e. none of the segments are designated as outstanding waters). The Division will also evaluate discharges to stream segments with established TMDLs, discharges to 303(d) listed waters, and other receiving water information as appropriate.

IV. SECTOR DESCRIPTION

A. Industry Description

Facilities with Remediation Activities in Colorado can be described as facilities engaged in Remediation Activities of groundwater, alluvial water, stormwater, and/or surface water (the source water) that will be discharged to surface waters and that is:

- Contaminated from specific industrial sources to include former dry cleaners, gasoline stations, industrial manufacturing facilities, etc.
- Contaminated from an unknown sources.
- Contaminated with naturally occurring constituents at concentrations that trigger water quality based effluent limits for discharges to surface water based on a Reasonable Potential Analysis (see Part VI.A.2.g).

B. Chemical Usage

Facilities potentially use a variety of chemicals during the treatment process for discharges from Remediation Activities. For this general permit the Division has required applicants to submit a list of proposed chemicals, including dosage rates, used in the treatment process. Additionally, a MSDS for each chemical proposed for use must be provided so that the Division can determine the appropriate effluent limitations and conditions to include in the certification. Additional sampling and monitoring requirements may be imposed based on the chemicals used.

The permittee shall notify the Division of any change in chemical usage associated with the permitted discharge in accordance with Part II.A.2 of the Permit.

V. COMPLIANCE HISTORY

The Division reviewed DMR data for the 25 facilities covered under this general permit. Some facilities received compliance advisories for failure to submit DMRs. A few facilities have continual numeric effluent limitation violations. The Division will evaluate whether these facilities will have to modify their treatment and contain their effluent until the modified treatment has confirmed that the effluent limitations have been met. Coverage under this renewed general permit may not be certified for a current permittee if compliance information from the previous permit term indicates that effluent limits in accordance with the permit do not ensure compliance with applicable water quality standards, control regulations, and the State and federal acts.

DMR review indicated that there were exceedances for various parameters including: Manganese, Iron, 1,4 Dioxane, Oil and Grease, MTBE, pH, Vinyl Chloride, 1,1,2,2-Tetrachloroethane, Chloroform, 1,2-Dichloroethane, Methylene Chloride, Carbon tetrachloride, Bromodichloromethane, 1,2-Dichloropropane, N-Nitrosodi-N-propylamine, Whole Effluent Toxicity Testing, Methyl tert-butyl ether, and Total Suspended Solids.

The Division had determined that a root cause for the high rate of exceedances of effluent limits in certifications under the previous permit was the implementation of treatment systems inadequate to remove pollutants as necessary to comply with those effluent limits. The Division has determined that for facilities covered under this permit, relying only on design calculation to determine if a facility will be capable of complying with effluent limits is inadequate to ensure compliance with applicable water quality standards, control regulations, and the State and federal acts. This iteration of the permit therefore requires containment of an initial batch of effluent until analyses have confirmed that all numeric effluent limitations have been met.

VI. TERMS AND CONDITIONS OF THE PERMIT

A. Discussion of Numeric Effluent Limitations

1. Technology Based Limitations

   a. Federal Effluent Limitation Guidelines – There are no Federal Effluent Limitation Guidelines for this category of discharge.

   b. Regulation 62: Regulations for Effluent Limitations – These Regulations include effluent limitations that apply to all discharges of wastewater to State waters. These regulations are applicable to the discharge from the Remediation Activities.

      i. Total Suspended Solids - The Division's current permit includes numeric technology-based limits for TSS based on Regulation 62. The Division has retained those more stringent requirements in this renewal permit for all dischargers as required by the anti-backsliding provision in CWA § 402(o). These limitations are the same as those contained in the previous permit and are imposed upon the effective date of this permit.

      ii. Oil and Grease – The oil and grease limitations from the Regulations for Effluent Limitations are applied as they are the most stringent limitations. These limitations are the same as those contained in the previous permit and are imposed upon the effective date of this permit.

      iii. pH - The pH limitation specified in the Regulations for Effluent Limitations is not the most stringent and thus is not used.

2. Water Quality Regulations, Policies, and Guidance Documents

   a. Antidegradation – As stated in The Basic Standards and Methodologies for Surface Water, Section 31.8, an antidegradation (AD) analysis is required for all discharges to waters designated "reviewable", except in cases where the regulated activity will result in only temporary or short term changes in water quality. Therefore, short-term and intermittent discharges will be considered a temporary impact and exempted from the AD review.

   Under this general permit, long-term, continuous discharges to waters designated "reviewable" will get 15% of the water quality standard. This AD standard will be identified as a site specific limitation in the certification. If the permittee requests consideration of dilution, ambient water quality, or an AD alternatives analyis, then the permit applicant will need to appy for an individual permit.

b. Determination of Total Maximum Daily Loads (TMDLs) – Upon reissuance of the renewal certifications under this revised general permit, the Division will assess whether or not any permitted facility discharges to segments for which a TMDL has been completed. The Division has included a provision in the general permit that authorizes the inclusion of additional effluent limits and other terms and conditions in a certification for discharges to segments for which a TMDL has been completed. The determination whether compliance with numeric effluent limitations will be required will be made on a case by case basis.

c. Determination of Discharges to 303(d) Listed Waters—Upon reissuance of the renewal certifications under this revised general permit, the Division will assess whether or not any permitted facility discharges to segments on the 303(d) list of impaired waters. The Division has included a provision in the general permit that authorizes the inclusion of additional effluent limits and other terms and conditions in a certification for discharges to segments that are on the 303(d) list of impaired waters.

d. Colorado Mixing Zone Regulations –For this general permit, mixing zone regulations will not apply for discharges from Remediation Activities as all limitations are assigned as end of pipe limits based on the Water Quality Standards and Technology Based Limitations. The rationale for not applying mixing zone regulations is due to Division resource limitations and the time required to conduct a thorough analysis of the receiving stream and its' assimilative capacity. In addition, this level of analysis is more appropriate for the individual permit process in order to include public notice and comment opportunities. Not applying the mixing zone regulations is consistent with the previous iteration of the permit**.**

e. Total Phosphorus – As noted in the general permit, the Division will implement effluent limitations and monitoring conditions in the certification in accordance with the Phosphorus Control Regulations (Regulations, 71, 72, 73, and 74).

f. Flow—Flow limitations will be based on the capacity of the treatment system(s).

g. Reasonable Potential Analysis –An analysis must be performed to determine whether to include WQBELs in the permit. This reasonable potential (RP) analysis is based on the Determination of the Requirement to Include Water Quality Standards-Based Limits in CDPS Permits Based on Reasonable Potential, dated December, 2002. This guidance document utilizes both quantitative and qualitative approaches to establish RP depending on the amount of available data.

3. Pollutants Limited by Water Quality Standards

a. pH – pH was determined to be a potential pollutant of concern for discharges from Remediation Activities based on the frequent occurrence in groundwater contaminated by a variety of potential contaminants of pH levels that do not meet surface water standards and the variety of chemicals used in the treatment process that can result in further modification of pH levels.

This parameter is limited by the water quality standards of 6.5-9.0 s.u., as this range is more stringent than the range specified under the Regulations for Effluent Limitations. This limitation is the same as that contained in the previous permit and is imposed effective immediately.

b. Temperature—Temperature was evaluated to determine whether or not it was considered a potential pollutant of concern. The Division decided not to include monitoring for temperature on a permit-wide basis as facilities generally do not add heat during their processes. However, a case-by-case determination will be made as whether to include monitoring for temperature for facilities that containerize the effluent for extended periods of time causing the potential for temperature to be a pollutant of concern.

c. Metals—A case-by-case determination will be made as to whether or not metals are potential pollutants of concern that must be limited and/or monitored to protect the classified uses assigned to the receiving water. The case-by-case determination will be made based on the source water for the remedial activity discharge, chemicals used in the remedial process, concentrations of naturally occurring metals, the potential for the characterization of the source water to change due to locations of contaminant plumes, and data supplied with the permit application used to characterize the potential source water.

The limitations for metals are based upon the water quality standards and will come directly from the basin regulations (Regulations 32-38) and the Basic Standards and Methodologies for Surface Water (Regulation 31). Standards for metals in the basin regulations that are shown as Table Value Standards (TVS) must be derived from equations that depend on the receiving stream hardness or species of fish present. These equations can be found in the basin regulations (Regulations 32-38).

d. Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs)—A case-by-case determination will be made as to whether or not VOCs and/or SVOCs are potential pollutants of concern that must be limited and/or monitored to protect the classified uses assigned to the receiving water. The case-by-case determination will be made based on the source water for the remedial activity discharge, chemicals used in the remedial process, the potential for the characterization of the source water to change due to locations of contaminant plumes, and data supplied with the permit application used to characterize the potential source water.

The limitations for VOCs and SVOCs are based upon the water quality standards that come directly from the Basic Standards and Methodologies for Surface Water (Regulation 31). The numeric effluent limitations implemented are dependent on the beneficial use of the receiving stream.

4. Whole Effluent Toxicity (WET) Testing

a. Purpose of WET Testing – The Water Quality Control Division has established the use of WET testing as a method for identifying and controlling toxic discharges from wastewater treatment facilities. WET testing is being utilized as a means to ensure that there are no discharges of pollutants "in amounts, concentrations or combinations which are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life" as required by Section 31.11 (1) of the Basic Standards and Methodologies for Surface Waters.

b. Reasonable Potential (RP) for Including WET Testing in Certifications—A case-by-case determination will be made as to whether or not WET testing will be required based on

reasonable potential for the effluent to be toxic to aquatic life. The case-by-case determination will be made based on the following criteria:

i. Expected pollutants in the discharge—Facilities that have limited number of toxic pollutants that are adequately controlled through chemical specific effluent limits will have a lower RP. Facilities that have toxic pollutants for which there are no numeric water quality standards, or have a higher number of toxic pollutants and therefore an increased potential for synergistic effects, will have higher potential for RP.

ii. Variability of the discharge, in regards to WET test data or other toxic pollutants—Facilities that have a higher level of variability in WET testing results or other toxic pollutants will have a higher potential for RP.

iii. Chemical Usage—Facilities that use chemicals in the treatment process at dosages that are toxic to aquatic life will have a higher potential for RP.

c. Acute VS Chronic WET Requirements—This general permit is not implementing the mixing zone regulations as described in Part VI.A.2.d ,therefore the low flow is considered zero and the end of pipe limitations apply. In accordance with the Division's, Implementation of the Narrative Standard for Toxicity in Discharge Permits Using Whole Effluent Toxicity (WET) Testing policy (WET Policy), when end of pipe limitations apply, chronic WET requirements will normally be implemented. However, as documented in the WET Policy, where the discharge is intermittent, as defined in the permit, acute WET testing may be substituted for chronic WET testing. The basis for this is that the aquatic life would not have chronic exposure to the effluent.

d. Acute WET Monitoring –Monitoring for WET is being required using Ceriodaphnia dubia and fathead minnows. The permittee shall report the LC_{50} for each test.

e. Chronic WET Monitoring –Monitoring for WET chronic toxicity will be required using Ceriodaphnia sp. and fathead minnows. The results of the testing are to be reported on Division approved forms. The permittee will be required to conduct two types of statistical derivations on the data, one looking for any statistically significant difference in toxicity between the control and the effluent concentrations and the second identifying the IC_{25}, should one exist. Both sets of calculations will look at the full range of toxicity (lethality, growth and reproduction).

5. Salinity Regulations – In compliance with the Colorado River Salinity Standards and the Colorado Discharge Permit System Regulations, for discharges to the Colorado River Basin, the permittee shall monitor for total dissolved solids on a Monthly basis.

B. Terms and Conditions Necessary to Assure Compliance

Regulation 61.8(3)(f) includes a requirement for permits to include such terms and conditions as the Division determines to be necessary to ensure compliance with applicable control regulations, water quality standards, and the state and federal Act. The Division has determined that the following conditions are necessary for discharges authorized by this permit.

1. Containing Discharge to Ensure Numeric Effluent Limits Can Be Met: Due to the history of non-compliance with effluent limitations and the variability of the source water being treated, Part I.C.2 of this iteration of the permit requires containment of the initial batch of the effluent until analyses have confirmed that all numeric effluent limitations have been met. If the initial sample exceeds any limitations, additional treatment shall be completed prior to discharge to ensure compliance with the limitations. An additional sample must be collected, post-treatment, to confirm compliance with the limitations. Additional sampling and treatment shall be repeated, and all water shall be collected and retained, until monitoring results for the treated effluent verify compliance with the numeric effluent limitations identified in the permit certification.

   This provision may be waived for existing permittees on a case-by-case basis if the discharger has been able to demonstrate consistent compliance with the permit numeric effluent limitations. Prior to issuing renewal permits for existing permittees, the Division will review facility DMR data to verify whether or not the facility has demonstrated compliance with the permit numeric effluent limits. The permit certification will specifically state if this provision has been waived.

2. Remediation Activity Practices: Regulation 61.8(3)(r) includes a requirement for permits to include conditions for best management practices to control or abate the discharge of pollutants when the practices are reasonably necessary to achieve effluent limitations and standards. The Division has identified the common occurrence of failure to design and implement practices as necessary to ensure continuous compliance with the effluent limits. The Part I.C.3 permit therefore includes a requirement that management practices be implemented in accordance with good engineering, hydrologic and pollution control practices. The permit specifically identifies the need to ensure that control mechanisms are designed, implemented, and maintained with proper hydraulic and pollutant removal capacities. This requirement would make it a violation for a structural pollutant removal control to be operated in such a way that is outside of its design tolerances intended to ensure compliance with the numeric effluent limits. Examples would included failure to operate at the proper flow rate, maintain necessary capacity and holding time, apply proper rates and quantities of chemicals, and replace filters as necessary for proper function. Failure to properly implement and maintain practices can result in variations in pollutant removal ability of controls such that exceedance of numeric effluent limits may not be identified by the intermittent sampling required by the permit and therefore the requirement to implement practices is necessary to ensure ongoing compliance with numeric effluent limits. The specific requirement that remediation activity practices to be implemented in with good engineering, hydrologic and pollution control practices removal is intended to require consistent pollutant removal through proper operation of treatment controls.

3. Remediation Activities Management Plan: Part I.C.4 of this iteration of the permit also includes a requirement to develop, document, and implement a Remediation Activities Management Plan (Plan). The requirement for the Plan ensures that the practices implemented at the site are documented so that it is clear to the permittee, operator, and Division how the remediation practices at the site are to be implemented to maintain compliance with the permit. The plan is also required to describe practices that will be implemented to meet additional conditions of the permit, and to enable effective compliance oversight of the permitted facility.

4. Discharge Log: Discharges authorized by this permit often occur irregularly. This irregular nature can result in confusion for both the permittee and the Division in determining monitoring frequency and the application of both daily and averaged effluent limitations. A discharge monitoring log is therefore required by Part I.C.5 of the permit to identify when discharges are occurring from

permitted outfalls. This requirement applies to all dischargers but is intended to not result in a significant tracking and record keeping burden for those discharges that are on-going.

5. Practices for Discharges in Exceedance of Applicable Water Quality Standards: Pollutant concentrations in the influent for discharges authorized by this permit can change significantly over time. These changes can be impossible to predict and therefore makes it likely that the permittee will not be able to notify the Division of the change in discharge as required by Part II.A.2 of the permit prior to the change occurring. Without this notification and the ability to respond proactively, the Division does not have the ability to determine if the altered discharge is consistent with the conditions of the permit and whether or not the permit continues to ensure compliance with applicable control regulations, water quality standards, and the state and federal Act.

   The previous iteration of this permit addressed this concern by not authorizing any pollutant not identified in the permit certification. The Division has determined that this requirement is infeasible since it would result in a violation for pollutants that were present even when there is no potential for an exceedance of a water quality standard or when the permittee is unaware of the pollutants' presence. Therefore, Part I.C.7 of the permit includes requirements for the permittee to respond to changes in discharge only when the permittee becomes aware that pollutant concentrations in the discharge exceed any applicable water quality standards for the receiving water for a pollutant not subject to an effluent limitation in the permit certification. The permit also provides additional conditions that would allow a discharge to continue in compliance with the permit if the permittee can prevent the exceedance at the outfall. However, notification to the Division is required. The occurrence of an exceedance of a water quality standard at the outfall for a pollutant without an effluent limitation will likely result in the Division requiring a new or revised permit application and shall follow the procedures specified in Sections 61.5 through 61.6, and 61.15 of the Colorado Discharge Permit System Regulations.

C. Monitoring

1. Effluent Monitoring – Effluent monitoring will be required as shown in the general permit. The monitoring frequencies for some parameters deviate from the Baseline Monitoring Frequency, Sample Type, and Reduced Monitoring Frequency Policy (Monitoring Policy). However, according to the Monitoring Policy, intermittent type discharges such as batch type discharges are not subject the Monitoring Policy. Since discharges permitted under this general permit have the potential to be both continuous and of batch type, the Division established the monitoring frequencies based on the variability of the source water and type of activity resulting in the discharge to State waters. However, the monitoring frequencies are consistent with the previous iteration of the permit.

   Monitoring locations will be authorized in the permit certification. Facilities wanting to request a reduction in monitoring frequency must request so through the modification process. The Division will evaluate if a reduction in monitoring frequency can be made in accordance with the Monitoring Policy. Subsequently, upon permit renewal, facilities that have previously been granted a reduction in monitoring frequency will be re-evaluated against the criteria set forth in the Policy to determine if monitoring reductions can continue.

2. Influent Monitoring—Since the source water being discharged under this general permit has the high potential to change based on proximity to groundwater contaminant plumes and groundwater flow, quarterly influent monitoring is required. The Division established the influent monitoring

frequency based on potential for variability of the source water and the type of activity producing the discharge.

D. Reporting

1. Discharge Monitoring Report – Facilities authorized under this general permit must submit Discharge Monitoring Reports (DMRs) on a **monthly** basis to the Division. These reports should contain the required summarization of the test results for all parameters and monitoring frequencies shown in Part I.B of the permit. See the permit, Part I.B, C, D and/or E for details on such submission.

2. Special Reports – Special reports are required in the event of an upset, bypass, or other noncompliance. Please refer to Part II.A. of the permit for reporting requirements. Submittal of these reports to the US Environmental Protection Agency Region VIII is no longer required.

E. Spills

Spill requirements apply to materials spilled that result in their presence in the discharge authorized under this permit. Spills that may cause pollution of state waters that are not discharged through an outfall authorized under this general permit are not within the scope of this general permit and are required to be reported in accordance with the Colorado Water Quality Control Act 25-8-601(2), since the Division views these actions as not authorized under the scope of a discharge permit. Additional information regarding reporting of unauthorized spills is contained in the Divisions Guidance for Reporting Spills.

F. Compliance Schedules

Compliance schedules are authorized to be included in certifications as needed. The Division anticipates that a compliance schedule may be appropriate for implementation of the more restrictive Antidegradation limitations for example. All information and written reports required by a compliance schedule should be directed to the Permits Section for final review unless otherwise stated.

G. Additional Terms and Conditions

1. Signatory and Certification Requirements – Signatory and certification requirements for reports and submittals are discussed in Part I.E.7. of the permit.

Nicole Rolfe
April 1, 2011

VII. REFERENCES

A. Colorado Department of Public Health and Environment, Water Quality Control Division Files, for facilities currently authorized under this permit.

B. Basic Standards and Methodologies for Surface Water, Regulation No. 31, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective November 30, 2009.

C. Colorado Discharge Permit System Regulations, Regulation No. 61, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective September 30, 2009.

D. Regulations for Effluent Limitations, Regulation No. 62, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective March 30, 2008.

E. Colorado River Salinity Standards, Regulation No. 39, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective August 30, 1997.

F. Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance, Colorado Department of Public Health and Environment, Water Quality Control Division, effective December 2001.

G. Memorandum Re: First Update to (Antidegradation) Guidance Version 1.0, Colorado Department of Public Health and Environment, Water Quality Control Division, effective April 23, 2002.

H. Determination of the Requirement to Include Water Quality Standards-Based Limits in CDPS Permits Based on Reasonable Potential Procedural Guidance, Colorado Department of Public Health and Environment, Water Quality Control Division, effective December 2002.

I. The Colorado Mixing Zone Implementation Guidance, Colorado Department of Public Health and Environment, Water Quality Control Division, effective April 2002.

J. Baseline Monitoring Frequency, Sample Type, and Reduced Monitoring Frequency Policy for Domestic and Industrial Wastewater Treatment Facilities, Water Quality Control Division Policy WQP-20, May 1, 2007.

K. Policy for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-23, effective July 3, 2008.

L. Policy for Implementation of the Narrative Standard for Toxicity in Discharge Permits Using Whole Effluent Toxicity (WET) Testing, Colorado Department of Public Health and Environment, Water Quality Control Division Policy Number WPC Program Permits-1, effective September 30, 2010.

VIII. PUBLIC NOTICE COMMENTS

The City and County of Denver (CCoD) provided the only written comments during the Public Notice Period. Summaries of these comments and the Division's response are provided below. The full comments and supporting documents are contained in the permit file and available upon request from the Division's Records Center.

Comment 1—Part I.B.3, Monitoring Frequencies and Sample Types for Influent Parameters
The requirement that a permittee seeking relief from influent sampling substantiate that constituents are not present in influent at concentrations more than one half the underlying surface water standard seems unreasonable and excessive. The text should clarify that this requirement applies only to constituents that are not already in the permit.

> ***Response 1****—Because the source of the discharge authorized under this general permit is highly variable due to changes in ground water flow from the pumping of ground water, the Division does not consider this requirement to be unreasonable or excessive. Contrary, the Division feels this requirement is necessary in order to maintain compliance with Part I.C.6 of the permit. The permit requires influent monitoring and reporting for parameters listed in Table B.3 (See Part III of the permit for each listed parameter) including those parameters with a numeric effluent limit in the permit (certification). Monitoring of constituents in the influent with a numeric effluent limit in the permit (certification) is required to identify changes that could result in the necessity for revised treatment and to meet the intent of Part II.A.2 of the permit to identify any changes that could result in an altered discharge.*

Comment 2—Part I.B.3, Monitoring Frequencies and Sample Types for Influent Parameters
The permit should include a provision allowing the permittee to demonstrate that constituents in influent that are not included in the permit will not result in an exceedance of a water quality standard in the receiving water. The demonstration could be performed by evaluating the assimilative capacity of the receiving water, in-stream monitoring, or modeling. The permittee could then petition the Division for relief from influent monitoring requirements.

> ***Response 2—****Consistent with Part. I.C.11 of the permit, all effluent limitations are assigned as end of pipe limits based on the Water Quality Standards. An assessment to determine the assimilative capacities for the receiving stream for each pollutant of concern is not applicable to this permit. Dischargers who want consideration of a mixing allowance or ambient stream conditions should apply for an individual permit.*

Comment 3—Part I.B.3, Monitoring Frequencies and Sample Types for Influent Parameters
Section 3 is confusing. Clarification is needed on influent monitoring frequency.

> ***Response 3****—The Division reworded the footnotes to state that the influent must be monitored once per quarter and in accordance with Part I.B.3. of the permit.*

Comment 4—Part I.C.7, WET Testing-Outfall(s)
We recommend adding a reference to the Fact Sheet for clarity regarding reasonable potential for WET.

> ***Response 4****—The Division has added a reference to the Fact Sheet which explains the reasonable potential for inclusion of WET testing as a permit requirement.*

Comment 5—Part I.C.7, WET Testing-Outfall(s), 4th paragraph
WET tests are typically performed by an outside party, and there is the potential for control failure during tests. CCoD recommends adding the italicized text to the permit language:

If a test is considered invalid, the permittee is required to perform additional testing during the monitoring period to obtain a valid test result. *Unless demonstrated that the permittee took appropriate steps to acquire valid WET test results,* failure to obtain a valid test result during the monitoring period shall result in a violation of the permit for failure to monitor.

> ***Response 5*** *–The Division's expectation is that permittees comply with the terms and conditions of the permit and exercise proper operation and maintenance which includes adequate laboratory controls and quality assurance procedures. If for any reason a permittee is unable to comply with the WET testing requirements or is unable to obtain valid WET test results, the permittee shall provide the Division with the proper noncompliance notification demonstrating that they exercised due diligence and there were factors beyond their control that prevented them from obtaining valid WET test results. The suggested language was not be added to the permit.*

Comment 6—Part I.C.7.a.iii, Automatic Compliance Response
The listed permit reference for the description of the Toxicity Identification Evaluation / Toxicity Reduction Evaluation (TIE /TRE) investigation does not seem correct.

> ***Response 6—****The Division corrected the reference to TIE/TRE in the permit.*

Comment 7—Part I.C.7.b, Chronic WET Testing
Would it take an Individual Permit or just a modified General Permit to change the IWC from 100% to something that may be more appropriate for a given project? If it can be demonstrated that the discharge is a small percentage of minimum instream flows (i.e., <5%), would this not justify a lower IWC percentage?

> ***Response 7—****As in previous iterations of this general permit, the IWC is set to 100%. In order to change the IWC from 100% to a lower IWC percentage, a discharger would have to apply for an individual permit. Additional language was added to the permit stating that the permittee should apply for an individual permit for consideration of a lower IWC percentage.*

Comment 8—Part I.C.8, Chemical Additions
The proposed revised permit states that no chemicals are to be added to the discharge unless the WQCD first grants permission. Please define at which point in the treatment system that the water is considered 'discharge'.

> ***Response 8 –****The Division reworded the language to clarify that the requirement addresses chemicals that have the potential to be present in the permitted discharge. This would include, but is not limited to, chemical additions at any point in the treatment system.*

Comment 9—Part I.D, Definition of Terms
Information contained in the definition of antidegradation limits appears to be a requirement for permittees to implement and not a definition. CCoD suggests moving the text to a more suitable location in the permit and rewording the requirements so that they are clearer

> **Response 9—***The Division removed the "Antidegradation limits" definition since the definition described the method for calculating the two year rolling average. An "Antidegradation" definition was added.*

Comment 10—Part I.E.3, Analytical and Sampling Methods for Monitoring
The analytical sampling text on calculation of average concentrations does not appear to be consistent with the definitions of "seven day average" and "thirty day average" and should be modified to avoid confusion.

Response 10—*The Division reworded the language within Part I.E.3 as it pertains to calculating average concentrations. Text within the "Seven (7) day average" and "Thirty (30) day average" definitions pertaining to calculating the Seven (7) day and Thirty (30) day averages was removed and language referencing Part I.E.3 (Analytical and Sampling Methods for Monitoring and Reporting) was added.*

Comment 11—Part II.A.5, Other Notification Requirements
The text notes that manufacturing, commercial, mining, and silvicultural dischargers must notify the Division when certain criteria are or are expected to be reached. CCoD recommends removing the text as it does not appear to be relevant to this permit.

Response 11*—Part II.A.5 is boiler plate language which exists in all CDPS industrial general permits. Since the language does not cause any conflict with the permit requirements, the language will not be removed.*

Comment 12—Will the changes in the new permit be implemented through permit revisions or will existing permits remain unchanged until the permit is renewed?

Response 12*—Existing permit certifications will remain unchanged until the permit becomes issued and effective. All existing permittee's wishing to continue permit coverage under the revised permit were required to have filed a permit renewal application. Once the revised permit is issued, each existing permittee with a renewal application on file will be issued a new permit certification with an effective date set to that of the effective date of the revised general permit. Where a permit certification has new or more stringent limitations, where necessary and in accordance with Regulation 61, the facility will be given a schedule for compliance that will include specific deadlines for the facility to achieve compliance with the new or more stringent limitation(s) as soon as possible.*

Comment 13—What will be the agency's response time to new permits and requested modifications? CCoD recommends that the current 30 day review time remain in place so as not to delay development projects or redevelopment of Brownfields sites and subsequently potentially affecting the economics of the projects.

Response 13*—As stated in Part I.A.3 of the permit, the Division has changed the application deadline from 30 days to 45 days before the anticipated date of discharge. The longer review period is necessary for the Division to complete the certification issuance process.*

Comment 14—It seems that the proposed revised permit treats all sites the same as a water treatment facility regardless of size, including the need for a certified operator to run the treatment facility. If that is WQ's intent, that may not be appropriate for all types of discharges from remediation activities. It is not clear how the proposed permit requirements can be practically, or cost effectively, implemented for smaller remediate projects. CCoD recommends that CDPHE WQCD propose and implement a subset of the permit requirements for smaller projects.

Response 14—*It is the Division's intent to treat all sites (regardless of size) the same that are discharging treated or remediated ground water, alluvial water, stormwater, and /or surface water. The nature of a general permit is to regulate a category of discharge and is not based on the quantity of discharge or size of the project. According to Regulation 61,Colorado Discharge Permit System Regulations, the general permit shall be written to regulate a category of point sources if the sources all a) involve the same or substantially similar types of operations; b) discharge the same types of wastes; c) require the same effluent limitations or operating conditions; d) require the same or similar monitoring; and e) in the opinion of the Director, are more appropriately controlled under a general permit than under individual permits.*

Nicole Rolfe
July 26, 2011

COLORADO DISCHARGE PERMIT SYSTEM (CDPS)
RATIONALE FOR MODIFICATION 1
REMEDIATION ACTIVITIES DISCHARGING TO SURFACE WATER
CDPS PERMIT NUMBER COG-315000

TABLE OF CONTENTS

I. TYPE OF PERMIT *Modification #1 (Minor Modification) to the Remediation Activities Discharging to Surface Water Master General Permit*

II. GENERAL PERMIT INFORMATION

A. *Activities Covered:* *Discharges from remediation activities to surface waters of the state.*

B. *Fee Category:* *Oil and Gas Cleanup , Category 7, Subcategory 8*
Annual Fee: *$1,840 per year*
Amendment Fee: *$0.00*

III. PURPOSE OF MODIFICATION

Upon certification reissuance, the Division discovered:

1. *The Acute Whole Effluent Toxicity (WET) parameter citations and limitations within the Numeric Effluent Limitations and Monitoring Requirements Tables B.1 and B.2 were incorrect and inconsistent with the narrative language in the permit. Table B.1 and Table B.2 listed the parameter for Acute WET as Pimephales lethality and Ceriodaphnia lethality. Both with Daily Maximum limitations of Report LC50. Since Acute testing requires a 48 hour WET test using Ceriodaphnia and an acute 96-hour WET test using Pimephales, the correct Acute WET parameter citation should state LC50 Statre 96Hr Acute using Pimephales and LC50 statre 48Hr Acute using Ceriodaphnia. The limitations for both should be LC50≥100% as a Daily Minimum rather than Report LC50. Existing language in Part I.C.7 of the permit, WET Testing-Outfalls, accurately describes the Acute WET Testing requirements.*

2. *The Chronic WET parameter citations and limitations within the Numeric Effluent Limitations and Monitoring Requirements Tables B.1 and B.2 were incorrect and inconsistent with the narrative language in the permit. Table B.1 and Table B.2 listed the parameter for Chronic WET as Pimephales lethality and toxicity and Ceriodaphnia lethality and toxicity. Both with Daily Maximum limitations of Report Stat Diff and IC25. Since Chronic testing must be conducted using a static 7-day test on both Ceriodaphnia and Pimephales, the correct Chronic WET parameter citation should state Static Renewal 7 Day Chronic using Pimephales and Static Renewal 7 Day Chronic using Ceriodaphnia. The Daily Minimum limitations for both should be NOEC or IC25 >100% rather than Report Stat Diff and IC25. Existing language in Part I.C.7 of the permit, WET Testing-Outfalls, accurately describes the Chronic WET Testing requirements.*

IV. CHANGES MADE AS A RESULT OF THE AMENDMENT

The Division made the necessary modification to the Numeric Effluent Limitations and Monitoring Requirements Tables B.1 and B.2 of permit to correct the WET parameter citations and limitations.

Nicole Rolfe
September 1, 2011

AMENDED: September 1, 2011 EFFECTIVE: October 1, 2011 EXPIRATION: SEPTEMBER 30, 2016

COLORADO DISCHARGE PERMIT SYSTEM (CDPS)
FACT SHEET TO PERMIT NUMBER COG315000
GENERAL PERMIT FOR DISCHARGES FROM REMEDIATION ACTIVITIES

TABLE OF CONTENTS

I. TYPE OF PERMIT

Master General, NPDES, Surface Water, Fifth Renewal, Statewide

II. SCOPE OF THE GENERAL PERMIT

A. SIC Code: 1799 Special Trade Contractors, Not Elsewhere Classified
1629 Heavy Construction, Not Elsewhere Classified

B. Major Changes from Last Renewal:

The current general permit, which expired on October 31, 2010 and has been administratively extended by the Water Quality Control Division (Division), provides coverage for 25 Facilities with Remediation Activities. This renewed general permit is needed to continue to provide coverage for these established dischargers and for new groundwater remediation facilities that are operating throughout Colorado. Major changes from last renewal include the following:

- Inclusion of requirements to develop, document, and implement a Remediation Discharge Activities Management Plan in accordance with good engineering, hydrologic and pollution control practices to ensure compliance with effluent limitations and other permit conditions.
- Inclusion of a provision that requires dischargers to contain the initial effluent until analyses have confirmed that all numeric effluent limitations have been met. The Division has been including this condition in certifications under the current permit
- Quarterly influent screen for Base, Neutral, Acids, Volatile Organic Compounds, and Metals to detect changes in discharge
- Inclusion of practices required for discharges in exceedance of water quality standards
- Limitations on coverage to exclude discharges to groundwater or to outstanding waters

C. Facilities Covered:

This general permit is to authorize discharges from Remediation Activities to surface waters of the State in Colorado. Only facilities with activities that meet the definition of Remediation Activities are eligible for coverage under the general permit.

Table II-1 lists the 25 entities currently covered under the administratively extended Groundwater Remediation General Permit. The Division has received renewal applications for these 25 facilities.

Table II-1—Inventory of Facilities with Certifications under the Current General Permit

Certification	Facility	Discharge Flow Rate	Receiving Stream(s)
COG315025	*Municipal Service Center*	*001A-16.4 GPM*	*Little Dry Creek, within segment 16c Upper South Platte River Sub-basin*
COG315144	*Blanton Mountain Mart*	*001A-30 GPM*	*Tributary to Illinois River, within segment 4 of the North Platte River Sub-basin*
COG315146	*Hamilton Sundstrand Facility*	*001A-145 GPM* *002A-6.6 GPM*	*Little Dry Creek and Kalcevic Gulch, both within segment 16b of the Clear Creek Sub-basin*
COG315147	*Olde's Texaco Service Facility*	*001A-10 GPM*	*Tributary to Bear Creek, within Segment 1a of the Bear Creek Sub-basin*
COG315157	*RTD Tunnel 16 Groundwater Treatment Facility*	*003A-350 GPM*	*South Platte River, within Segment 14 of the Upper South Platte River Sub-basin*
COG315161	*Dietrich Standard Corporation*	*001A-40 GPM*	*Tributary to Dry Creek, within Segment 6 of the St. Vrain Sub-basin*
COG315165	*12000 W Cedar Dr Lot*	*001A-30 GPM*	*Lakewood Gulch, Segment 16c of the Upper South Platte River Sub-basin*
COG315169	*CDOT Materials Testing Lab*	*001A-1.5 GPM*	*Cherry Creek, Segment 03 of the Cherry Creek Sub-basin*
COG315176	*Raytheon Boulder Facility*	*001A-12 GPM* *002A-36 GPM*	*Both to tributaries to Dry Creek, within Segment 6 of the St. Vrain Sub-basin*
COG315179	*A and W Loveland Quick Trip Lust*	*001A-30 GPM*	*Big Barnes Ditch, within Segment 6 of the Big Thompson River Sub-basin*
COG315180	*Broderick Wood Prod Superfund*	*001A-67 GPM* *001B-67 GPM* *002A-80 GPM*	*Clear Creek, within Segment 15 of the Clear Creek Sub-basin*
COG315182	*BP Service Station 12001*	*001A-10 GPM*	*Clear Creek, within Segment 15 of the Clear Creek Sub-basin*
COG315183	*Former Redfield site*	*001A-40 GPM*	*Unnamed ditch tributary to Goldsmith Gulch, within Segment 4 of the Cherry Creek Sub-basin*
COG315197	*400 E 104 Ave Lot*	*001A-5 GPM*	*Grange Hall Creek-tributary to the South Platte River, within Segment 16c of the Upper South Platte River Sub-*

			basin
COG315198	*Wadsworth 66 Service Station*	*001A-5 GPM*	*Sanderson Gulch-tributary to the South Platte River, within Segment 16c of Upper South Platte River Sub-basin*
COG315210	*Pecos Street Grade Separation*	*001A- 450 GPM* *002A-450 GPM*	*Karen's Pond, tributary to Clear Creek, and directly to Clear Creek, both within Segment 15.*
COG315211	*Residence at 29 St Lot 4*	*001A-30 GPM*	*Boulder Creek, Segment 02b of the Boulder Creek Sub-basin, South Platte River Basin*
COG315215	*Mesa to Skylake Pipeline Project*	*SW 001A-200 GPM (Mobile to surface water)* *GW 001A-200 GPM (Mobile to Groundwater)*	*First Creek, Second Creek and the South Platte River, within segments 15, 16c, and 16d of the Upper South Platte River Sub-basin and* ***Groundwater***
COG315216	*W Main Pipeline Integrity Mgmt Program*	*200 GPM (Mobile)*	*Big Thompson River, within segment 04a of the Big Thompson River Sub-basin and to* ***Groundwater***
COG315217	*Kenwood Outfall*	*001A-100 GPM*	*South Platte River, Segment 15 of the Upper South Platte River Sub-basin*
COG315219	*Dahlia Ponds*	*001A-2,000--4,000 GPM*	*South Platte River, Segment 15 of the Upper South Platte River Sub-basin*
COG315224	*I-25 and Alameda Ave Project*	*001A-350 GPM* *002A-1,500 GPM*	*South Platte River, Segment 14 of the Upper South Platte River Sub-basin*
COG315225	*Denver Union Station*	*001A-1,000 GPM*	*South Platte River, Segment 14 of the Upper South Platte River Sub-basin*
COG315226	*South Platte River - Lower Lakewood Gulch*	*001A-120 GPM*	*South Platte River, Segment 14 of the Upper South Platte River Sub-basin*

D. Limitations on Coverage:

The Division included a limitation of coverage related to having representative data of the contaminated source water in order to characterize the waste stream and to identify all parameters which will require monitoring and/or numeric effluent limitations.

There are some discharges from Remediation Activities that cannot be covered under this general permit and must apply for coverage under another general permit or under an individual permit. These exclusions include discharges from Remediation Activities that:

- include other wastewaters (i.e., domestic wastewaters),
- are land applied or otherwise released to groundwater, or
- are to receiving waters designated as "outstanding waters"

Discharges that include other wastewaters such as domestic wastewaters are excluded on the basis that there may be additional pollutants of concern and other discharge characteristics that were not evaluated in the development of this general permit.

Land application or other discharges to groundwater are excluded from this permit. There are two current facilities with certifications authorizing discharges to groundwater. The Division will work directly with these two facilities to determine the best permitting approach for these discharges.

The Division requires that discharges to outstanding waters be authorized only by an individual permit, since a site specific evaluation is needed to meet the antidegradation requirements of Regulation 31.

E. Application Requirements:

Remediation facilities can apply for coverage under this general permit upon the issuance and effective date of the permit by submitting a complete and accurate application at least 45 days prior to the anticipated discharge. Following review of the application, the Division may request additional information. Upon receipt of the additional information, the Division shall have additional time to issue or deny the authorization to discharge.

Existing facilities with certifications under the administratively extended Groundwater Remediation General Permit (COG-315000) that have submitted renewal applications and qualify for coverage under the new general permit will automatically be transferred. Coverage will be transferred to the new general permit without a lapse of coverage (i.e. discharging without a permit) and without loss of fee payments.

The CDPS general permit for Construction Dewatering activities (COG-070000) authorizes discharges from similar activities as this general permit, but for which Remediation Activities are not conducted. As part of the Division‘s review of an application for coverage under COG-070000, or based on the availability of new information for facilities with existing coverage, the Division will assess the potential for various sources of contamination to be present in the discharge. Water quality based effluent limits may be required based on a Reasonable Potential Analysis (see Part VI.A.2.g) due to the presence of contaminants in the source water. Coverage under COG-070000 will not be authorized by the Division if remediation activities will be conducted for the discharge based on these water quality based effluent limits. If the applicant wishes to obtain coverage under the Remediation Activities general permit for the discharge, the following information must be submitted to the Division:

- a statement requesting that the information received in the Construction Dewatering application be applied towards the Remediation Activities Permit application,
- source water characterization data, and
- a description of the treatment utilized in order to meet limitations
- additional information as requested by the Division

All information must be submitted by the permit applicant legal contact and signed in accordance with Part I.E.7 of the permit.

III. RECEIVING STREAM

The Division has identified the stream segments to which the facilities with current certifications under the general permit discharge. The Division expects to continue coverage for these facilities under this general permit since the stream standards and designations are consistent with the limitations on coverage in the general

permit (i.e. none of the segments are designated as outstanding waters). The Division will also evaluate discharges to stream segments with established TMDLs, discharges to 303(d) listed waters, and other receiving water information as appropriate.

IV. SECTOR DESCRIPTION

A. Industry Description

Facilities with Remediation Activities in Colorado can be described as facilities engaged in Remediation Activities of groundwater, alluvial water, stormwater, and/or surface water (the source water) that will be discharged to surface waters and that is:

- Contaminated from specific industrial sources to include former dry cleaners, gasoline stations, industrial manufacturing facilities, etc.
- Contaminated from an unknown sources.
- Contaminated with naturally occurring constituents at concentrations that trigger water quality based effluent limits for discharges to surface water based on a Reasonable Potential Analysis (see Part VI.A.2.g).

B. Chemical Usage

Facilities potentially use a variety of chemicals during the treatment process for discharges from Remediation Activities. For this general permit the Division has required applicants to submit a list of proposed chemicals, including dosage rates, used in the treatment process. Additionally, a MSDS for each chemical proposed for use must be provided so that the Division can determine the appropriate effluent limitations and conditions to include in the certification. Additional sampling and monitoring requirements may be imposed based on the chemicals used.

The permittee shall notify the Division of any change in chemical usage associated with the permitted discharge in accordance with Part II.A.2 of the Permit.

V. COMPLIANCE HISTORY

The Division reviewed DMR data for the 25 facilities covered under this general permit. Some facilities received compliance advisories for failure to submit DMRs. A few facilities have continual numeric effluent limitation violations. The Division will evaluate whether these facilities will have to modify their treatment and contain their effluent until the modified treatment has confirmed that the effluent limitations have been met. Coverage under this renewed general permit may not be certified for a current permittee if compliance information from the previous permit term indicates that effluent limits in accordance with the permit do not ensure compliance with applicable water quality standards, control regulations, and the State and federal acts.

DMR review indicated that there were exceedances for various parameters including: Manganese, Iron, 1,4 Dioxane, Oil and Grease, MTBE, pH, Vinyl Chloride, 1,1,2,2-Tetrachloroethane, Chloroform, 1,2-Dichloroethane, Methylene Chloride, Carbon tetrachloride, Bromodichloromethane, 1,2-Dichloropropane, N-Nitrosodi-N-propylamine, Whole Effluent Toxicity Testing, Methyl tert-butyl ether, and Total Suspended Solids.

The Division had determined that a root cause for the high rate of exceedances of effluent limits in certifications under the previous permit was the implementation of treatment systems inadequate to remove pollutants as necessary to comply with those effluent limits. The Division has determined that for facilities covered under this permit, relying only on design calculation to determine if a facility will be capable of complying with effluent limits is inadequate to ensure compliance with applicable water quality standards, control regulations, and the State and federal acts. This iteration of the permit therefore requires containment of an initial batch of effluent until analyses have confirmed that all numeric effluent limitations have been met.

VI. TERMS AND CONDITIONS OF THE PERMIT

A. Discussion of Numeric Effluent Limitations

1. Technology Based Limitations

   a. Federal Effluent Limitation Guidelines – There are no Federal Effluent Limitation Guidelines for this category of discharge.

   b. Regulation 62: Regulations for Effluent Limitations – These Regulations include effluent limitations that apply to all discharges of wastewater to State waters. These regulations are applicable to the discharge from the Remediation Activities.

      i. Total Suspended Solids - The Division's current permit includes numeric technology-based limits for TSS based on Regulation 62. The Division has retained those more stringent requirements in this renewal permit for all dischargers as required by the anti-backsliding provision in CWA § 402(o). These limitations are the same as those contained in the previous permit and are imposed upon the effective date of this permit.

      ii. Oil and Grease – The oil and grease limitations from the Regulations for Effluent Limitations are applied as they are the most stringent limitations. These limitations are the same as those contained in the previous permit and are imposed upon the effective date of this permit.

      iii. pH - The pH limitation specified in the Regulations for Effluent Limitations is not the most stringent and thus is not used.

2. Water Quality Regulations, Policies, and Guidance Documents

   a. Antidegradation – As stated in The Basic Standards and Methodologies for Surface Water, Section 31.8, an antidegradation (AD) analysis is required for all discharges to waters designated ~~–r~~eviewable", except in cases where the regulated activity will result in only temporary or short term changes in water quality. Therefore, short-term and intermittent discharges will be considered a temporary impact and exempted from the AD review.

      Under this general permit, long-term, continuous discharges to waters designated ~~–r~~eviewable" will get 15% of the water quality standard. This AD standard will be identified as a site specific limitation in the certification. If the permittee requests consideration of dilution, ambient water quality, or an AD alternatives analyis, then the permit applicant will need to appy for an individual permit.

b. Determination of Total Maximum Daily Loads (TMDLs) – Upon reissuance of the renewal certifications under this revised general permit, the Division will assess whether or not any permitted facility discharges to segments for which a TMDL has been completed. The Division has included a provision in the general permit that authorizes the inclusion of additional effluent limits and other terms and conditions in a certification for discharges to segments for which a TMDL has been completed. The determination whether compliance with numeric effluent limitations will be required will be made on a case by case basis.

c. Determination of Discharges to 303(d) Listed Waters—Upon reissuance of the renewal certifications under this revised general permit, the Division will assess whether or not any permitted facility discharges to segments on the 303(d) list of impaired waters. The Division has included a provision in the general permit that authorizes the inclusion of additional effluent limits and other terms and conditions in a certification for discharges to segments that are on the 303(d) list of impaired waters.

d. Colorado Mixing Zone Regulations –For this general permit, mixing zone regulations will not apply for discharges from Remediation Activities as all limitations are assigned as end of pipe limits based on the Water Quality Standards and Technology Based Limitations. The rationale for not applying mixing zone regulations is due to Division resource limitations and the time required to conduct a thorough analysis of the receiving stream and its' assimilative capacity. In addition, this level of analysis is more appropriate for the individual permit process in order to include public notice and comment opportunities. Not applying the mixing zone regulations is consistent with the previous iteration of the permit**.**

e. Total Phosphorus – As noted in the general permit, the Division will implement effluent limitations and monitoring conditions in the certification in accordance with the Phosphorus Control Regulations (Regulations, 71, 72, 73, and 74).

f. Flow—Flow limitations will be based on the capacity of the treatment system(s).

g. Reasonable Potential Analysis –An analysis must be performed to determine whether to include WQBELs in the permit. This reasonable potential (RP) analysis is based on the Determination of the Requirement to Include Water Quality Standards-Based Limits in CDPS Permits Based on Reasonable Potential, dated December, 2002. This guidance document utilizes both quantitative and qualitative approaches to establish RP depending on the amount of available data.

3. Pollutants Limited by Water Quality Standards

a. pH – pH was determined to be a potential pollutant of concern for discharges from Remediation Activities based on the frequent occurrence in groundwater contaminated by a variety of potential contaminants of pH levels that do not meet surface water standards and the variety of chemicals used in the treatment process that can result in further modification of pH levels.

This parameter is limited by the water quality standards of 6.5-9.0 s.u., as this range is more stringent than the range specified under the Regulations for Effluent Limitations. This limitation is the same as that contained in the previous permit and is imposed effective immediately.

b. Temperature—Temperature was evaluated to determine whether or not it was considered a potential pollutant of concern. The Division decided not to include monitoring for temperature on a permit-wide basis as facilities generally do not add heat during their processes. However, a case-by-case determination will be made as whether to include monitoring for temperature for facilities that containerize the effluent for extended periods of time causing the potential for temperature to be a pollutant of concern.

c. Metals—A case-by-case determination will be made as to whether or not metals are potential pollutants of concern that must be limited and/or monitored to protect the classified uses assigned to the receiving water. The case-by-case determination will be made based on the source water for the remedial activity discharge, chemicals used in the remedial process, concentrations of naturally occurring metals, the potential for the characterization of the source water to change due to locations of contaminant plumes, and data supplied with the permit application used to characterize the potential source water.

The limitations for metals are based upon the water quality standards and will come directly from the basin regulations (Regulations 32-38) and the Basic Standards and Methodologies for Surface Water (Regulation 31). Standards for metals in the basin regulations that are shown as Table Value Standards (TVS) must be derived from equations that depend on the receiving stream hardness or species of fish present. These equations can be found in the basin regulations (Regulations 32-38).

d. Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs)—A case-by-case determination will be made as to whether or not VOCs and/or SVOCs are potential pollutants of concern that must be limited and/or monitored to protect the classified uses assigned to the receiving water. The case-by-case determination will be made based on the source water for the remedial activity discharge, chemicals used in the remedial process, the potential for the characterization of the source water to change due to locations of contaminant plumes, and data supplied with the permit application used to characterize the potential source water.

The limitations for VOCs and SVOCs are based upon the water quality standards that come directly from the Basic Standards and Methodologies for Surface Water (Regulation 31). The numeric effluent limitations implemented are dependent on the beneficial use of the receiving stream.

4. Whole Effluent Toxicity (WET) Testing

a. Purpose of WET Testing – The Water Quality Control Division has established the use of WET testing as a method for identifying and controlling toxic discharges from wastewater treatment facilities. WET testing is being utilized as a means to ensure that there are no discharges of pollutants "in amounts, concentrations or combinations which are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life" as required by Section 31.11 (1) of the Basic Standards and Methodologies for Surface Waters.

b. Reasonable Potential (RP) for Including WET Testing in Certifications—A case-by-case determination will be made as to whether or not WET testing will be required based on

reasonable potential for the effluent to be toxic to aquatic life. The case-by-case determination will be made based on the following criteria:

i. Expected pollutants in the discharge—Facilities that have limited number of toxic pollutants that are adequately controlled through chemical specific effluent limits will have a lower RP. Facilities that have toxic pollutants for which there are no numeric water quality standards, or have a higher number of toxic pollutants and therefore an increased potential for synergistic effects, will have higher potential for RP.

ii. Variability of the discharge, in regards to WET test data or other toxic pollutants—Facilities that have a higher level of variability in WET testing results or other toxic pollutants will have a higher potential for RP.

iii. Chemical Usage—Facilities that use chemicals in the treatment process at dosages that are toxic to aquatic life will have a higher potential for RP.

c. Acute VS Chronic WET Requirements—This general permit is not implementing the mixing zone regulations as described in Part VI.A.2.d ,therefore the low flow is considered zero and the end of pipe limitations apply. In accordance with the Division's, Implementation of the Narrative Standard for Toxicity in Discharge Permits Using Whole Effluent Toxicity (WET) Testing policy (WET Policy), when end of pipe limitations apply, chronic WET requirements will normally be implemented. However, as documented in the WET Policy, where the discharge is intermittent, as defined in the permit, acute WET testing may be substituted for chronic WET testing. The basis for this is that the aquatic life would not have chronic exposure to the effluent.

d. Acute WET Monitoring –Monitoring for WET is being required using Ceriodaphnia dubia and fathead minnows. The permittee shall report the LC_{50} for each test.

e. Chronic WET Monitoring –Monitoring for WET chronic toxicity will be required using Ceriodaphnia sp. and fathead minnows. The results of the testing are to be reported on Division approved forms. The permittee will be required to conduct two types of statistical derivations on the data, one looking for any statistically significant difference in toxicity between the control and the effluent concentrations and the second identifying the IC_{25}, should one exist. Both sets of calculations will look at the full range of toxicity (lethality, growth and reproduction).

5. Salinity Regulations – In compliance with the Colorado River Salinity Standards and the Colorado Discharge Permit System Regulations, for discharges to the Colorado River Basin, the permittee shall monitor for total dissolved solids on a Monthly basis.

B. Terms and Conditions Necessary to Assure Compliance

Regulation 61.8(3)(f) includes a requirement for permits to include such terms and conditions as the Division determines to be necessary to ensure compliance with applicable control regulations, water quality standards, and the state and federal Act. The Division has determined that the following conditions are necessary for discharges authorized by this permit.

1. Containing Discharge to Ensure Numeric Effluent Limits Can Be Met: Due to the history of non-compliance with effluent limitations and the variability of the source water being treated, Part I.C.2 of this iteration of the permit requires containment of the initial batch of the effluent until analyses have confirmed that all numeric effluent limitations have been met. If the initial sample exceeds any limitations, additional treatment shall be completed prior to discharge to ensure compliance with the limitations. An additional sample must be collected, post-treatment, to confirm compliance with the limitations. Additional sampling and treatment shall be repeated, and all water shall be collected and retained, until monitoring results for the treated effluent verify compliance with the numeric effluent limitations identified in the permit certification.

   This provision may be waived for existing permittees on a case-by-case basis if the discharger has been able to demonstrate consistent compliance with the permit numeric effluent limitations. Prior to issuing renewal permits for existing permittees, the Division will review facility DMR data to verify whether or not the facility has demonstrated compliance with the permit numeric effluent limits. The permit certification will specifically state if this provision has been waived.

2. Remediation Activity Practices: Regulation 61.8(3)(r) includes a requirement for permits to include conditions for best management practices to control or abate the discharge of pollutants when the practices are reasonably necessary to achieve effluent limitations and standards. The Division has identified the common occurrence of failure to design and implement practices as necessary to ensure continuous compliance with the effluent limits. The Part I.C.3 permit therefore includes a requirement that management practices be implemented in accordance with good engineering, hydrologic and pollution control practices. The permit specifically identifies the need to ensure that control mechanisms are designed, implemented, and maintained with proper hydraulic and pollutant removal capacities. This requirement would make it a violation for a structural pollutant removal control to be operated in such a way that is outside of its design tolerances intended to ensure compliance with the numeric effluent limits. Examples would included failure to operate at the proper flow rate, maintain necessary capacity and holding time, apply proper rates and quantities of chemicals, and replace filters as necessary for proper function. Failure to properly implement and maintain practices can result in variations in pollutant removal ability of controls such that exceedance of numeric effluent limits may not be identified by the intermittent sampling required by the permit and therefore the requirement to implement practices is necessary to ensure ongoing compliance with numeric effluent limits. The specific requirement that remediation activity practices to be implemented in with good engineering, hydrologic and pollution control practices removal is intended to require consistent pollutant removal through proper operation of treatment controls.

3. Remediation Activities Management Plan: Part I.C.4 of this iteration of the permit also includes a requirement to develop, document, and implement a Remediation Activities Management Plan (Plan). The requirement for the Plan ensures that the practices implemented at the site are documented so that it is clear to the permittee, operator, and Division how the remediation practices at the site are to be implemented to maintain compliance with the permit. The plan is also required to describe practices that will be implemented to meet additional conditions of the permit, and to enable effective compliance oversight of the permitted facility.

4. Discharge Log: Discharges authorized by this permit often occur irregularly. This irregular nature can result in confusion for both the permittee and the Division in determining monitoring frequency and the application of both daily and averaged effluent limitations. A discharge monitoring log is therefore required by Part I.C.5 of the permit to identify when discharges are occurring from

permitted outfalls. This requirement applies to all dischargers but is intended to not result in a significant tracking and record keeping burden for those discharges that are on-going.

5. Practices for Discharges in Exceedance of Applicable Water Quality Standards: Pollutant concentrations in the influent for discharges authorized by this permit can change significantly over time. These changes can be impossible to predict and therefore makes it likely that the permittee will not be able to notify the Division of the change in discharge as required by Part II.A.2 of the permit prior to the change occurring. Without this notification and the ability to respond proactively, the Division does not have the ability to determine if the altered discharge is consistent with the conditions of the permit and whether or not the permit continues to ensure compliance with applicable control regulations, water quality standards, and the state and federal Act.

   The previous iteration of this permit addressed this concern by not authorizing any pollutant not identified in the permit certification. The Division has determined that this requirement is infeasible since it would result in a violation for pollutants that were present even when there is no potential for an exceedance of a water quality standard or when the permittee is unaware of the pollutants' presence. Therefore, Part I.C.7 of the permit includes requirements for the permittee to respond to changes in discharge only when the permittee becomes aware that pollutant concentrations in the discharge exceed any applicable water quality standards for the receiving water for a pollutant not subject to an effluent limitation in the permit certification. The permit also provides additional conditions that would allow a discharge to continue in compliance with the permit if the permittee can prevent the exceedance at the outfall. However, notification to the Division is required. The occurrence of an exceedance of a water quality standard at the outfall for a pollutant without an effluent limitation will likely result in the Division requiring a new or revised permit application and shall follow the procedures specified in Sections 61.5 through 61.6, and 61.15 of the Colorado Discharge Permit System Regulations.

C. Monitoring

1. Effluent Monitoring – Effluent monitoring will be required as shown in the general permit. The monitoring frequencies for some parameters deviate from the Baseline Monitoring Frequency, Sample Type, and Reduced Monitoring Frequency Policy (Monitoring Policy). However, according to the Monitoring Policy, intermittent type discharges such as batch type discharges are not subject the Monitoring Policy. Since discharges permitted under this general permit have the potential to be both continuous and of batch type, the Division established the monitoring frequencies based on the variability of the source water and type of activity resulting in the discharge to State waters. However, the monitoring frequencies are consistent with the previous iteration of the permit.

   Monitoring locations will be authorized in the permit certification. Facilities wanting to request a reduction in monitoring frequency must request so through the modification process. The Division will evaluate if a reduction in monitoring frequency can be made in accordance with the Monitoring Policy. Subsequently, upon permit renewal, facilities that have previously been granted a reduction in monitoring frequency will be re-evaluated against the criteria set forth in the Policy to determine if monitoring reductions can continue.

2. Influent Monitoring—Since the source water being discharged under this general permit has the high potential to change based on proximity to groundwater contaminant plumes and groundwater flow, quarterly influent monitoring is required. The Division established the influent monitoring

frequency based on potential for variability of the source water and the type of activity producing the discharge.

D. Reporting

1. Discharge Monitoring Report – Facilities authorized under this general permit must submit Discharge Monitoring Reports (DMRs) on a **monthly** basis to the Division. These reports should contain the required summarization of the test results for all parameters and monitoring frequencies shown in Part I.B of the permit. See the permit, Part I.B, C, D and/or E for details on such submission.

2. Special Reports – Special reports are required in the event of an upset, bypass, or other noncompliance. Please refer to Part II.A. of the permit for reporting requirements. Submittal of these reports to the US Environmental Protection Agency Region VIII is no longer required.

E. Spills

Spill requirements apply to materials spilled that result in their presence in the discharge authorized under this permit. Spills that may cause pollution of state waters that are not discharged through an outfall authorized under this general permit are not within the scope of this general permit and are required to be reported in accordance with the Colorado Water Quality Control Act 25-8-601(2), since the Division views these actions as not authorized under the scope of a discharge permit. Additional information regarding reporting of unauthorized spills is contained in the Divisions Guidance for Reporting Spills.

F. Compliance Schedules

Compliance schedules are authorized to be included in certifications as needed. The Division anticipates that a compliance schedule may be appropriate for implementation of the more restrictive Antidegradation limitations for example. All information and written reports required by a compliance schedule should be directed to the Permits Section for final review unless otherwise stated.

G. Additional Terms and Conditions

1. Signatory and Certification Requirements – Signatory and certification requirements for reports and submittals are discussed in Part I.E.7. of the permit.

Nicole Rolfe
April 1, 2011

VII. REFERENCES

A. Colorado Department of Public Health and Environment, Water Quality Control Division Files, for facilities currently authorized under this permit.

B. Basic Standards and Methodologies for Surface Water, Regulation No. 31, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective November 30, 2009.

C. Colorado Discharge Permit System Regulations, Regulation No. 61, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective September 30, 2009.

D. Regulations for Effluent Limitations, Regulation No. 62, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective March 30, 2008.

E. Colorado River Salinity Standards, Regulation No. 39, Colorado Department of Public Health and Environment, Water Quality Control Commission, effective August 30, 1997.

F. Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance, Colorado Department of Public Health and Environment, Water Quality Control Division, effective December 2001.

G. Memorandum Re: First Update to (Antidegradation) Guidance Version 1.0, Colorado Department of Public Health and Environment, Water Quality Control Division, effective April 23, 2002.

H. Determination of the Requirement to Include Water Quality Standards-Based Limits in CDPS Permits Based on Reasonable Potential Procedural Guidance, Colorado Department of Public Health and Environment, Water Quality Control Division, effective December 2002.

I. The Colorado Mixing Zone Implementation Guidance, Colorado Department of Public Health and Environment, Water Quality Control Division, effective April 2002.

J. Baseline Monitoring Frequency, Sample Type, and Reduced Monitoring Frequency Policy for Domestic and Industrial Wastewater Treatment Facilities, Water Quality Control Division Policy WQP-20, May 1, 2007.

K. Policy for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-23, effective July 3, 2008.

L. Policy for Implementation of the Narrative Standard for Toxicity in Discharge Permits Using Whole Effluent Toxicity (WET) Testing, Colorado Department of Public Health and Environment, Water Quality Control Division Policy Number WPC Program Permits-1, effective September 30, 2010.

VIII. PUBLIC NOTICE COMMENTS

The City and County of Denver (CCoD) provided the only written comments during the Public Notice Period. Summaries of these comments and the Division‘s response are provided below. The full comments and supporting documents are contained in the permit file and available upon request from the Division‘s Records Center.

Comment 1—Part I.B.3, Monitoring Frequencies and Sample Types for Influent Parameters
The requirement that a permittee seeking relief from influent sampling substantiate that constituents are not present in influent at concentrations more than one half the underlying surface water standard seems unreasonable and excessive. The text should clarify that this requirement applies only to constituents that are not already in the permit.

> ***Response 1****—Because the source of the discharge authorized under this general permit is highly variable due to changes in ground water flow from the pumping of ground water, the Division does not consider this requirement to be unreasonable or excessive. Contrary, the Division feels this requirement is necessary in order to maintain compliance with Part I.C.6 of the permit. The permit requires influent monitoring and reporting for parameters listed in Table B.3 (See Part III of the permit for each listed parameter) including those parameters with a numeric effluent limit in the permit (certification). Monitoring of constituents in the influent with a numeric effluent limit in the permit (certification) is required to identify changes that could result in the necessity for revised treatment and to meet the intent of Part II.A.2 of the permit to identify any changes that could result in an altered discharge.*

Comment 2—Part I.B.3, Monitoring Frequencies and Sample Types for Influent Parameters
The permit should include a provision allowing the permittee to demonstrate that constituents in influent that are not included in the permit will not result in an exceedance of a water quality standard in the receiving water. The demonstration could be performed by evaluating the assimilative capacity of the receiving water, in-stream monitoring, or modeling. The permittee could then petition the Division for relief from influent monitoring requirements.

> ***Response 2—****Consistent with Part. I.C.11 of the permit, all effluent limitations are assigned as end of pipe limits based on the Water Quality Standards. An assessment to determine the assimilative capacities for the receiving stream for each pollutant of concern is not applicable to this permit. Dischargers who want consideration of a mixing allowance or ambient stream conditions should apply for an individual permit.*

Comment 3—Part I.B.3, Monitoring Frequencies and Sample Types for Influent Parameters
Section 3 is confusing. Clarification is needed on influent monitoring frequency.

> ***Response 3****—The Division reworded the footnotes to state that the influent must be monitored once per quarter and in accordance with Part I.B.3. of the permit.*

Comment 4—Part I.C.7, WET Testing-Outfall(s)
We recommend adding a reference to the Fact Sheet for clarity regarding reasonable potential for WET.

> ***Response 4****—The Division has added a reference to the Fact Sheet which explains the reasonable potential for inclusion of WET testing as a permit requirement.*

Comment 5—Part I.C.7, WET Testing-Outfall(s), 4th paragraph
WET tests are typically performed by an outside party, and there is the potential for control failure during tests. CCoD recommends adding the italicized text to the permit language:

If a test is considered invalid, the permittee is required to perform additional testing during the monitoring period to obtain a valid test result. *Unless demonstrated that the permittee took appropriate steps to acquire valid WET test results,* failure to obtain a valid test result during the monitoring period shall result in a violation of the permit for failure to monitor.

> ***Response 5*** *–The Division's expectation is that permittees comply with the terms and conditions of the permit and exercise proper operation and maintenance which includes adequate laboratory controls and quality assurance procedures. If for any reason a permittee is unable to comply with the WET testing requirements or is unable to obtain valid WET test results, the permittee shall provide the Division with the proper noncompliance notification demonstrating that they exercised due diligence and there were factors beyond their control that prevented them from obtaining valid WET test results. The suggested language was not be added to the permit.*

Comment 6—Part I.C.7.a.iii, Automatic Compliance Response
The listed permit reference for the description of the Toxicity Identification Evaluation / Toxicity Reduction Evaluation (TIE /TRE) investigation does not seem correct.

> ***Response 6—****The Division corrected the reference to TIE/TRE in the permit.*

Comment 7—Part I.C.7.b, Chronic WET Testing
Would it take an Individual Permit or just a modified General Permit to change the IWC from 100% to something that may be more appropriate for a given project? If it can be demonstrated that the discharge is a small percentage of minimum instream flows (i.e., <5%), would this not justify a lower IWC percentage?

> ***Response 7—****As in previous iterations of this general permit, the IWC is set to 100%. In order to change the IWC from 100% to a lower IWC percentage, a discharger would have to apply for an individual permit. Additional language was added to the permit stating that the permittee should apply for an individual permit for consideration of a lower IWC percentage.*

Comment 8—Part I.C.8, Chemical Additions
The proposed revised permit states that no chemicals are to be added to the discharge unless the WQCD first grants permission. Please define at which point in the treatment system that the water is considered ‗discharge'.

> ***Response 8 –****The Division reworded the language to clarify that the requirement addresses chemicals that have the potential to be present in the permitted discharge. This would include, but is not limited to, chemical additions at any point in the treatment system.*

Comment 9—Part I.D, Definition of Terms
Information contained in the definition of antidegradation limits appears to be a requirement for permittees to implement and not a definition. CCoD suggests moving the text to a more suitable location in the permit and rewording the requirements so that they are clearer

> **Response 9—***The Division removed the ―Antidegradation limits" definition since the definition described the method for calculating the two year rolling average. An ―Antidegradation" definition was added.*

Comment 10—Part I.E.3, Analytical and Sampling Methods for Monitoring
The analytical sampling text on calculation of average concentrations does not appear to be consistent with the definitions of ~~–s~~even day average" and ~~–t~~hirty day average" and should be modified to avoid confusion.

Response 10—*The Division reworded the language within Part I.E.3 as it pertains to calculating average concentrations. Text within the ~~–S~~even (7) day average" and "Thirty (30) day average" definitions pertaining to calculating the Seven (7) day and Thirty (30) day averages was removed and language referencing Part I.E.3 (Analytical and Sampling Methods for Monitoring and Reporting) was added.*

Comment 11—Part II.A.5, Other Notification Requirements
The text notes that manufacturing, commercial, mining, and silvicultural dischargers must notify the Division when certain criteria are or are expected to be reached. CCoD recommends removing the text as it does not appear to be relevant to this permit.

Response 11*—Part II.A.5 is boiler plate language which exists in all CDPS industrial general permits. Since the language does not cause any conflict with the permit requirements, the language will not be removed.*

Comment 12—Will the changes in the new permit be implemented through permit revisions or will existing permits remain unchanged until the permit is renewed?

Response 12*—Existing permit certifications will remain unchanged until the permit becomes issued and effective. All existing permittee's wishing to continue permit coverage under the revised permit were required to have filed a permit renewal application. Once the revised permit is issued, each existing permittee with a renewal application on file will be issued a new permit certification with an effective date set to that of the effective date of the revised general permit. Where a permit certification has new or more stringent limitations, where necessary and in accordance with Regulation 61, the facility will be given a schedule for compliance that will include specific deadlines for the facility to achieve compliance with the new or more stringent limitation(s) as soon as possible.*

Comment 13—What will be the agency's response time to new permits and requested modifications? CCoD recommends that the current 30 day review time remain in place so as not to delay development projects or redevelopment of Brownfields sites and subsequently potentially affecting the economics of the projects.

Response 13*—As stated in Part I.A.3 of the permit, the Division has changed the application deadline from 30 days to 45 days before the anticipated date of discharge. The longer review period is necessary for the Division to complete the certification issuance process.*

Comment 14—It seems that the proposed revised permit treats all sites the same as a water treatment facility regardless of size, including the need for a certified operator to run the treatment facility. If that is WQ's intent, that may not be appropriate for all types of discharges from remediation activities. It is not clear how the proposed permit requirements can be practically, or cost effectively, implemented for smaller remediate projects. CCoD recommends that CDPHE WQCD propose and implement a subset of the permit requirements for smaller projects.

Response 14—*It is the Division's intent to treat all sites (regardless of size) the same that are discharging treated or remediated ground water, alluvial water, stormwater, and /or surface water. The nature of a general permit is to regulate a category of discharge and is not based on the quantity of discharge or size of the project. According to Regulation 61,Colorado Discharge Permit System Regulations, the general permit shall be written to regulate a category of point sources if the sources all a) involve the same or substantially similar types of operations; b) discharge the same types of wastes; c) require the same effluent limitations or operating conditions; d) require the same or similar monitoring; and e) in the opinion of the Director, are more appropriately controlled under a general permit than under individual permits.*

Nicole Rolfe
July 26, 2011

COLORADO DISCHARGE PERMIT SYSTEM (CDPS)
FACT SHEET TO PERMIT NUMBER COG315000
GENERAL PERMIT FOR DISCHARGES FROM REMEDIATION ACTIVITIES

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I. TYPE OF PERMIT

Master General, NPDES, Surface Water, Fifth Renewal, Statewide

II. SCOPE OF THE GENERAL PERMIT

A. SIC Code: 1799 Special Trade Contractors, Not Elsewhere Classified
1629 Heavy Construction, Not Elsewhere Classified

B. Minor Modification #2

Division initiated minor changes were made to the language in Part I(E)(1) of the permit, to clarify the submittal date for monthly and quarterly DMRs.

Margo Griffin
May 5, 2014

Colorado Department of Public Health and Environment

CDPS GENERAL PERMIT COG315000

REMEDIATION ACTIVITIES DISCHARGING TO SURFACE WATER

AUTHORIZATION TO DISCHARGE UNDER THE

COLORADO DISCHARGE PERMIT SYSTEM

In compliance with the provisions of the Colorado Water Quality Control Act, (25-8-101 et seq., CRS, 1973 as amended) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq.; the "Act"), Remediation Activities are authorized to discharge treated water from authorized locations throughout the State of Colorado to specified surface waters of the State. Such discharges shall be in accordance with the conditions of this general permit.

This permit specifically authorizes the entity(s) listed on page 1 of this document (also known as the permit certification) to discharge process generated wastewaters, as of the effective dates stated on page 1 of the certification, in accordance with the permit requirements and conditions set forth in Parts I and II hereof. All discharges authorized herein shall be consistent with the terms and conditions of this permit.

The applicant may demand an adjudicatory hearing within thirty (30) days of the date of issuance of the final permit determination, per the Colorado Discharge Permit System Regulations, 61.7(1). Should the applicant choose to contest any of the effluent limitations, monitoring requirements or other conditions contained herein, the applicant must comply with Section 24-4-104 CRS and the Colorado Discharge Permit System Regulations. Failure to contest any such effluent limitation, monitoring requirement, or other condition, constitutes consent to the condition by the Applicant.

This permit and the authorization to discharge shall expire at midnight September 30, 2016

Modified and Signed this day 20th day of May, 2014

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Janet Kieler, Permits Section Manager
WATER QUALITY CONTROL DIVISION

Permit Action Summary:
Minor Modification #2—Issued May 20, 2014, Effective May 20, 2014: Part I.E.1
Minor Modification #1—Issued September 1, 2011, Effective October 1, 2011
Originally Issued and Signed: August 3, 2011, Effective October 1, 2011

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PART I

A. COVERAGE UNDER THIS PERMIT

1. Activities Covered

This permit authorizes the discharge from Remediation Activities from authorized locations throughout the State of Colorado to surface waters of the state. Remediation Activities means treatment and/or remedial activities of groundwater, alluvial water, stormwater, and/or surface water (the source water). RAs occur at facilities including, but are not limited to: Industrial Sites, Leaking Underground Storage Tanks (LUSTs), Gasoline Stations, Dry Cleaners and Construction Dewatering sites where contaminated groundwater, alluvial water, stormwater, and/or surface water is encountered.

2. Limitations on Coverage

Discharges from Remediation Activities may be covered under this permit provided that the applicant can provide representative data of the contaminated source water at the time of application. If the applicant is not able to provide the representative data, determinations will be made on a case-by-case basis as to whether coverage can be authorized under this general permit. These case-by-case determinations are based on resources and relevant information available to accurately evaluate and identify the potential contaminants in the source water. If it is determined that resources and relevant information are not available, an individual permit may be required.

There are some discharges from Remediation Activities that cannot be covered under this general permit and must apply for coverage under another general permit or under an individual permit. These exclusions include discharges to receiving waters designated as "outstanding waters" discharges that are land applied or otherwise released to groundwater and discharges that include domestic related wastewater.

3. Application Requirements

In order to apply for certification under this general permit, the applicant shall submit an application form as provided by the Division by mail or hand delivery at least 45 days before the anticipated date of discharge. The application in its entirety shall be submitted to:

Colorado Department of Public Health and Environment
Water Quality Control Division
Permits Section, WQCD-PCP-B2
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Following review of the application, the Division may request additional information or deny the authorization to discharge under this general permit. If the Division determines that a new facility does not fall under the authority of the general permit, then the information received will be processed for an individual permit, and the applicant shall be notified of such a determination. If during the renewal process, the Division determines that a facility no longer qualifies for the general permit, then the certification may be revoked or the facility may be allowed to discharge under the general permit, with additional conditions in the amended certification, until an individual permit is issued.

A permittee desiring continued coverage under the general permit must reapply **at least 180 days in advance of this permit expiration**. If this permit is not reissued or replaced prior to the expiration date, it will be administratively continued and remain in force and effect. If a permittee was authorized to discharge under this permit prior to the expiration date, any discharges authorized under this permit will automatically remain covered by this permit until the earliest of:

a. Authorization for coverage under a reissued permit or a replacement of this permit following the timely

and appropriate submittal of a complete application requesting authorization to discharge under the new permit and compliance with the requirements of the application;

b. The issuance and effect of a termination issued by the Division;

c. The issuance or denial of an individual permit for the facility's discharges;

d. A formal permit decision by the Division not to reissue this general permit, at which time the Division will identify a reasonable time period for covered dischargers to seek coverage under an alternative general permit or an individual permit. Coverage under this permit will cease when coverage under another permit is granted/authorized; or

e. The Division has informed the permittee that they are no longer covered under this permit.

4. Terminating Coverage

To terminate permit coverage, the legal permit applicant or duly authorized agent must submit a complete and accurate Notice of Termination Form, to the address listed in Part I.A.3. The authorization to discharge under this permit terminates at midnight of the day that the termination is effective as notified by the Division. The permittee is responsible for meeting the terms of this permit until the authorization is terminated. The Notice of Termination must be signed in accordance with Part I.E.7 of this permit.

5. Modifying Existing Permit Coverage

To modify an existing permit certification, the legal permit contact or duly authorized agent must submit a complete and accurate Modification Form, to the address listed in Part I.A.3. This form must be submitted to the Division at least 45 days prior to implementing any requested modifications that result in a discharge to state waters. The permittee is not authorized to discharge under the modified conditions until the modified certification is issued and effective. Modifications include but are not limited to: adding or removing discharge outfalls, adding new or additional chemicals to the treatment process or effluent, modifying treatment in a manner that would result in a new or altered discharge in terms of location or effluent quality, etc. The modification form must be signed in accordance with Part I.E.7 of this permit.

B. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Permitted Outfall(s)

Beginning no earlier than the effective date listed on the permit certification and lasting through the expiration date of this permit, the permittee identified on the permit certification is authorized to discharge from the Outfall(s) listed on the permit certification, provided that all conditions of this permit are met.

2. Numeric Effluent Limitations, Monitoring Frequencies, and Sample Types

In accordance with the Water Quality Control Commission Regulations for Effluent Limitations, Section 62.4, and the Colorado Discharge Permit System Regulations, Section 61.8(2), 5.C.C.R. 1002-61, the permitted discharge shall not contain effluent parameter concentrations which exceed the limitations specified in Table B.1 or B.2 and the permit certification.

The permittee must monitor the effluent for all listed parameters at the frequency and sample types specified in Table B.1 or B.2 below. Additional site specific parameters along with the discharge limitations and monitoring conditions may be included in the permit certification. Such monitoring will begin immediately and last for the life of the permit unless otherwise noted. The results of such monitoring must be reported on the Discharge Monitoring Report (DMR) form (See Part I.E). Facilities with continuous discharges may request a reduction in the monitoring frequency through the modification process. The Division will evaluate if a reduction in monitoring frequency can be made in accordance with the Division's Baseline Monitoring Frequency, Sample Type, and Reduced Monitoring Frequency Policy.

Long-term discharges to State waters designated as 'Reviewable' are subject to an antidegradation (AD)

review. Consideration of dilution, ambient water quality, or an AD alternatives analysis is not applicable under this general permit as all limits are end of pipe. As such, long-term discharges to designated reviewable segments will get 15% of the water quality standard and the AD limits will be noted in the permit certification. For additional information on the AD review see Part I.VI.A.2.a of the Permit Fact Sheet.

Table B.1, **Numeric Effluent Limitations and Monitoring Requirements for Continuous Discharges or Flow-Through Treatment**

Parameter ICIS Code		Discharge Limitations			Monitoring Conditions	
		30-Day Average	7-Day Average	Daily Maximum	Monitoring Frequency	Sample Type
50050 Flow, mgd[1]		Limit	----	Limit	Continuous	Recorder
00530 Total Suspended Solids, mg/l		30	45	-----	Weekly	Grab
84066 Oil and Grease[2]		----	-----	-----	Weekly	Visual
03582 Oil and Grease[2], mg/l		----	---	10	Weekly	Grab
00400 pH, s.u.		----	-----	6.5-9.0	Weekly	In-situ
70295 Total Dissolved Solids[3], mg/l		Report	------	Report	Monthly	Grab
00665 Total Phosphorus[4], mg/l, as P		Limit in Certification	----	----	Monthly	Grab
00665 Total Phosphorus[4], mg/l, as P		Report	------	Report	Monthly	Grab
WET[5], acute	TAN6C LC50 Statre 96Hr Acute *Pimpephales*	-----	-----	LC50 ≥ 100% (daily min)	Quarterly	Grab
	TAM3B LC50 Statre 48Hr Acute *Ceriodaphnia*	-----	-------	LC50 ≥ 100% (daily min)	Quarterly	Grab
WET[5], chronic	TCP6C Static Renewal 7 Day Chronic *Pimephales*	----	----	NOEC or IC25 >100% (daily min)	Quarterly	3 Grabs /test
	TCP3B Static Renewal 7 Day Chronic *Ceriodaphnia*	----	----	NOEC or IC25 >100% (daily min)	Quarterly	3 Grabs/test
Site Specific[6] Metals, Organics, Inorganics, Temperature, RADs		Report	-----	Report	Weekly	Grab
Site Specific[6] Metals, Organics, Inorganics, RADS		Limit in Certification	-----	Limit in Certification	Weekly	Grab

Table B.2, **Numeric Effluent Limitations and Monitoring Requirements for Intermittent Discharges including Batch Treatment**

Parameter ICIS Code		Discharge Limitations			Monitoring Conditions	
		30-Day Average	7-Day Average	Daily Maximum	Monitoring Frequency	Sample Type
50050 Flow, mgd[1]		Limit	----	Limit	Continuous	Recorder
00530 Total Suspended Solids, mg/l		30	45	-----	Weekly	Composite
84066 Oil and Grease[2]		----	-----	-----	Weekly	Visual
03582 Oil and Grease[2], mg/l		----	---	10	Weekly	Composite
00400 pH, s.u.		----	-----	6.5-9.0	Weekly	In-situ
70295 Total Dissolved Solids[3], mg/l		Report	------	Report	Monthly	Composite
00665 Total Phosphorus[4], mg/l, as P		Limit in Certification	----	----	Monthly	Composite
00665 Total Phosphorus[4], mg/l, as P		Report	------	Report	Monthly	Composite
WET[5], acute	TAN6C LC50 Statre 96Hr Acute *Pimpephales*	-----	-----	LC50 ≥ 100% (daily min)	Quarterly	Grab
	TAN6C LC50 Statre 96Hr Acute *Pimpephales*	-----	-----	LC50 ≥ 100% (daily min)	Quarterly	Grab
WET[5], chronic	TCP6C Static Renewal 7 Day Chronic *Pimephales*	----	----	NOEC or IC25 >100% (daily min)	Quarterly	3 Grabs /test
	TCP3B Static Renewal 7 Day Chronic *Ceriodaphnia*	----	----	NOEC or IC25 >100% (daily min)	Quarterly	3 Grabs/test
Site Specific[6] Metals, Organics, Inorganics, Temperature, RADs		Report	-----	Report	Weekly	Composite
Site Specific[6] Metals, Organics, Inorganics, RADS		Limit in Certification	-----	Limit in Certification	Weekly	Composite

Notes:

[1]Flow Limit—The chronic flow limit will be based on the design capacity of the treatment as provided in the permit application and will be stated on the certification.

[2]Oil and Grease—A visual observation of the discharge for each permitted outfall must be made once a week. In the event an oil sheen or floating oil is observed, a composite sample shall be collected weekly, analyzed, and reported on the DMR. In addition, corrective action shall be taken immediately to mitigate the discharge of oil

and grease. A description of the corrective action taken must be included with the DMR.

[3]Total Dissolved Solids (TDS)—Analysis for salinity, measured as TDS, will be required in all permits that discharge in the Colorado River Basin. Following the submittal of the initial six sets of monthly data, the Division shall determine whether the permittee is required to submit a report addressing salt removal in accordance with the Colorado River Salinity Standards, Regulation No. (5CCR 1002-39). If the salinity report is required, the Division shall so advise the permittee by letter or through the inclusion of a compliance schedule and the report shall be submitted within 180 days.

[4]Total Phosphorus—Analysis for Total Phosphorus, as P, will be required for discharges to waters with a control regulation for P. In accordance with the Dillon Reservoir Control Regulation (Regulation 71), monitoring for Total Phosphorus is required. In accordance with the Cherry Creek Reservoir Control Regulation (Regulation 72), monitoring and compliance with the Total Phosphorus chronic numeric effluent limit of 0.05mg/l is required. In accordance with the Chatfield Reservoir Control Regulation (Regulation 73), monitoring and compliance with the Total Phosphorus chronic numeric effluent limit of 1.0 mg/l is required. In accordance with the Bear Creek Watershed Control Regulation (Regulation 74), monitoring for Total Phosphorus is required.

[5]Whole Effluent Toxicity (WET) Testing—A site specific determination will be made as to whether WET testing will be required and will be stated in the permit certification. See Part I.C.7 for WET testing requirements and Part VI.A.4 of the Fact Sheet for the discussion on determining when WET testing is required.

[6]Site Specific Parameters—Upon review of the analytical data supplied with the permit application, site specific parameters will be added to the permit certification based on the type and concentrations of contaminants present. This may include monitoring requirements for Temperature, if there is potential for the permittee to containerize the effluent for extended periods of time. Additional site specific parameters may be added to the permit certification in accordance with Part I.B.3.

3. Monitoring Frequencies and Sample Types for Influent Parameters

The permittee must monitor the influent for all listed parameters at the frequency and sample types specified in Table B.3 below. Such monitoring shall be conducted after the discharge has commenced, but within the first month of discharge, and shall continue on a quarterly basis. The results of such monitoring must be reported on the Discharge Monitoring Report (DMR) form (See Part I.E) under Permitted Feature 300I.

After the review of the influent data, the Division may require a modification to the permit certification to include additional monitoring requirements and numeric effluent limitations, as established in Part I.B. The permittee will be notified if the Division requires any such modification.

In addition, the permittee must follow the procedures identified in Part I.C.6 if there is a potential exceedance of water quality standards at the permitted outfall, for a parameter not subject to an effluent limit in the permit/permit certification.

The influent sampling requirement established in Part I.B.3 may be waived on a case-by-case basis if the Division deems the pollutants in the source water have been well characterized or other pertinent information has been provided to the Division. This may be the case for fixed facilities treating a specific pollutant source, or for facilities with substantial historical groundwater data.

If after the submittal of four quarters of influent data substantiating constituents are not detected in concentrations more than one half the surface water standards, the permittee can request relief from the influent monitoring requirements.

Outfall: 300I

Table B.3, Monitoring Frequency and Sample Type Influent Parameters for Continuous and Intermittent Discharges including Batch Treatment

Parameter ICIS Code	Discharge Limitations			Monitoring Conditions	
	30-Day Average	7-Day Average	Daily Maximum	Monitoring Frequency	Sample Type
Semi Volatile Organic Compounds Screen [1]	Report	-----	Report	Quarterly	Grab
Volatile Organic Compounds Screen [2]	Report	-----	Report	Quarterly	Grab
Metals Screen [3]	Report	-----	Report	Quarterly	Grab

Notes:

[1] Semi-Volatile Organic Compound Screen—The permittee shall sample the influent once per quarter in accordance with Part I.B.3and have it analyzed for Semi-Volatile Organic Compounds listed in the Influent Screening Requirements found in Part III of the permit. Pesticides, herbicides, and PCBs do not need to be included in this analysis.

[2] Volatile Organic Compound Screen—The permittee shall sample the influent once per quarter in accordance with Part. I.B.3 and have it analyzed for Volatile Organic Compounds listed in the Influent Screening Requirements found in Part III of the permit.

[3] Metals Screen—The permittee shall sample the influent once per quarter in accordance with Part I.B.3 and have it analyzed for all metals listed in the Influent Screening Requirements found in Part III of the permit. The Metals analyses shall be performed for the extraction (Total Recoverable, Potentially Dissolved, and/or Dissolved form) identified in Part III of the permit.

C. TERMS AND CONDITIONS

1. Compliance Schedule

Existing dischargers may be granted compliance schedules for any new effluent limitations applicable to the discharge. Some items requiring a compliance schedule may require an individual permit.

2. Ensure Numeric Effluent Limits Can Be Met

Prior to the commencement of any discharge, an initial batch representative of the effluent from each permitted outfall must be sent through the treatment system. The effluent from the treatment must be sampled using composite method for all parameters listed in the permit certification with a numeric limitation. All effluent must be contained until analyses have confirmed that all numeric effluent limitations have been met. If the results of the initial sampling exceed any numeric effluent limitation, additional treatment shall be completed and additional sampling must be collected, post-treatment, to confirm compliance with the limitations. Additional sampling and treatment shall be repeated, and all water shall be collected and retained, until monitoring results for the treated effluent verify compliance with the numeric effluent limitations identified in the permit certification. Monitoring may be conducted and samples collected to meet the requirements of this section prior to certification under the general permit. This requirement will not be imposed for WET testing or for parameters where report only is required.

The initial containment of the effluent requirement established in Part I.C.2 may be waived for existing permittee's on a case-by-case basis. The case-by-case determination will be made based on numeric effluent limitation permit compliance history.

3. Remediation Activities Practices

The permittee shall develop and implement remediation activities practices for each facility covered by this permit in accordance with the requirements of this section. The remediation activities practices shall be documented in a Remediation Activities Management Plan in accordance with I.C.4. The practices shall include:

a. Pollutant Control Practices: The permittee shall implement pollutant control practices to meet all numeric effluent limitations in accordance with good engineering, hydrologic and pollution control practices. Specifically, the permittee must ensure all pollutant control practices are designed, implemented, and maintained with proper hydraulic and pollutant removal capacity to ensure consistent compliance with the permit effluent limits. Practices shall include all treatment, schedules of activities, prohibitions of practices, maintenance procedures, monitoring practices used to document the capability of the treatment practices to remove pollutants, including residual solids treatment, handling and disposal practices, and other management practices necessary to meet the numeric effluent limits.

b. Materials Handling and Spill Prevention: The permittee shall implement practices for material handling and spill prevention to prevent discharges that contain effluent parameter concentrations which exceed the limitations specified in Table B.1, Table B.2, and the permit certification, as well as discharges not authorized by a CDPS discharge permit. The permittee shall implement secondary containment for all bulk storage structures for petroleum products and any other chemicals associated with the pollutant control practices (e.g., fuel for pumps, chemicals used in the treatment process), or provide equivalent adequate protection so as to contain all spills and prevent any spilled material from entering the effluent stream or State waters.

4. Remediation Activities Management Plan

a. **Remediation Activities Management Plan (Plan) shall document the following information:**

i) Plan Administrator: The Plan shall identify a specific individual(s), position or title who is responsible for developing, implementing, maintaining, and revising the Plan. The activities and responsibilities of the administrator shall address all aspects of the facility's Plan.

ii) Facility Certified Operator: As documented in Regulation 100, all water and wastewater facilities in Colorado shall be under the supervision of an operator certified at or above the classification of the facility. The Plan shall identify a specific individual holding a certificate that meets the requirements of Regulation 100. If the permittee is not aware of the class of certification needed, contact the Division's Facility-Operator Program.

iii) Site Map: The Plan shall include a legible site map(s), showing the entire site, identifying:

i) The source of the discharge or dewatering excavations (if applicable)—Dewatering excavations can be described as locations where ground disturbing activities result in uncovering of groundwater
ii) Containment Location(s) if present,
iii) Location of structural treatment practices, including but not limited to tanks, filter systems, etc.
iv) Sampling Locations
v) Discharge Point(s)/Outfall(s)
vi) Identification of the conveyance into which the discharge point(s)/outfall(s) are directed (e.g., surface water, storm sewer, ditch, etc.)

iv) Description of Pollutant Control Practices: The Plan shall describe the installation and implementation specifications for each practice implemented in accordance with Part I.C.3.a. The description shall address the proper implementation and operation of the practice. The description shall include general information related to hydraulic and pollutant removal capacity of the pollutant treatment system, with related monitoring practices used to document the capability of the treatment practices to remove pollutants, including residual solids treatment, handling and disposal practices. The Plan shall clearly describe the inspection and maintenance procedures implemented at the site to maintain all pollutant control practices in good and effective operating condition.

v) Description of Materials Handling and Spill Prevention: The Plan shall identify the practices implemented for Materials Handling and Spill Prevention in accordance with Part I.C.3.b. The description shall identify the capacity and location of secondary containment implemented for all bulk storage structures. If equivalent adequate protection is implemented in lieu of secondary containment, the plan shall provide a description of the practices to be used.

b. **Plan Preparation and Implementation:** The Plan does not need to be completed prior to submitting a permit application. However, the Plan shall be completed and documented prior to commencement of the discharge. The Plan shall be maintained and implemented until expiration or inactivation of permit coverage.

c. **Plan Retention Requirements:** A copy of the Plan must be retained on site unless another location, specified by the permittee, is approved by the Division.

d. **Plan Availability:** A copy of the Plan shall be provided upon request to the Division or EPA in accordance with Part II.B.2. All Plans required under this permit are considered reports that shall be available to the public under Section 308(b) of the CWA and Section 61.5(4) of the Colorado Discharge Permit System Regulations. The permittee shall make plans available to members of the public upon request. However, the permittee may claim any portion of a Plan as confidential in accordance with 40 CFR Part 2.

e. **Plan Review/Changes:** The Plan must reflect current field conditions. Any changes in the pollutant control practices implemented at the site must be reflected in the Plan and may trigger additional requirements as established in Part II.A.2 of the permit. Plan changes shall be made prior to changes in the site conditions, except as allowed for in paragraph f, below.

f. **Responsive Plan Changes:** Plan changes addressing pollutant control practices are often required to be made in response to changing conditions, or when current practices are determined ineffective. The majority of Plan revisions to address these changes can be made immediately with quick in-the-field revisions to the plan. In the less common scenario where more complex development of materials to modify the Plan is necessary, Plan revisions shall be made in accordance with the following requirements:

i) the Plan shall be revised as soon as practicable, but in no case more than 72 hours after the change(s) in the pollutant control practices at the site, and
ii) a notation must be included in the Plan prior to the site change(s) that includes the time and date of the change(s) in the field, an identification of the changes in pollutant control practices.

5. **Discharge Log**

The permittee shall maintain a documented weekly Discharge Log identifying for each week (Sunday through Saturday) the following information for each permitted outfall:

i) the dates and times when a discharges commences and/or ends,
ii) records for monitoring as required by Part I.E.4.

The entries can be based off data obtained from the flow recorder. The log must be updated within 72 hours of the occurrence of any activity requiring documentation in accordance with this subsection.

6. **Practices for Discharges in Exceedance of Applicable Water Quality Standards**

The Division expects that compliance with the effluent limits in this permit will control discharges as necessary to meet applicable water quality standards. If at any time the permittee becomes aware that at the permitted outfall, pollutant concentrations for an effluent parameter **not** subject to an effluent limitation in Part I.B or the permit certification exceeds any applicable water quality standard for the receiving water, the permittee shall:

a. Halt or reduce any activity if necessary to prevent the discharge of an effluent parameter(s), at the permitted outfall, in concentrations which exceed the applicable water quality standards for the receiving water;

b. Report the exceedance of an acute effluent limitation and/or an exceedance of toxic substance listed in Part III of the permit orally within twenty-four (24) hours from the time the permittee becomes aware of the circumstances; and

c. Mail a written report to the Division containing all relevant monitoring data and the information consistent with that required for noncompliance in Part II.A.4 (a) within five (5) days after becoming aware of the exceedance.

Coverage under this general permit may be modified, suspended, or terminated by the Division if necessary to effectively implement protection of waters of the State. If the Division finds that such new or altered discharge might be inconsistent with the conditions of the permit, the Division shall require a new or revised permit application, or require coverage under an individual permit, and shall follow the procedures specified in Sections 61.5 through 61.6, and 61.15 of the Colorado Discharge Permit System Regulations.

The Division expects that compliance with the effluent limits in this permit will control discharges as necessary to meet applicable water quality standards. If at any time the permittee becomes aware that at the permitted outfall, pollutant concentrations for an effluent parameter subject to an effluent limitation in Part I.B or the permit certification exceeds any applicable water quality standard for the receiving water, the permittee shall follow the requirements stated in Part II., specifically Part II.A.4,10, and 14.

7. WET Testing-Outfall(s)

When the Division determines WET testing is required due to the expected pollutants in the discharge, variability in the discharge, and chemical usage chronic WET testing will normally be required (see Part VI.A.4 of Fact Sheet for Reasonable Potential to include WET). However, where the discharge is intermittent, as defined in Part I.D, acute WET may be substituted for chronic WET testing. The basis for this is that the aquatic life would not have chronic exposure to the effluent.

The following minimum dilution series should be used for both chronic and acute testing: 0% effluent (control), 20%, 40%, 60%, 80%, and 100% effluent. If the permittee uses more dilutions than prescribed, and accelerated testing is to be performed, the same dilution series shall be used in the accelerated testing as was

used in the failed test.

Tests shall be done at the frequency listed in Part I.B.2. Test results shall be reported along with the Discharge Monitoring Report (DMR) submitted for the end of the reporting period when the sample was taken. (i.e., WET testing results for the calendar quarter ending March 31 shall be reported with the DMR due April 28, etc.) The permittee shall submit all laboratory statistical summary sheets, summaries of the determination of a valid, invalid or inconclusive test, and copies of the chain of custody forms, along with the DMR for the reporting period.

If a test is considered invalid, the permittee is required to perform additional testing during the monitoring period to obtain a valid test result. Failure to obtain a valid test result during the monitoring period shall result in a violation of the permit for failure to monitor.

a. **Acute WET Testing**

i) General Acute WET Testing and Reporting Requirements: The permittee shall conduct an acute 48-hour WET test using Ceriodaphnia dubia, and an acute 96-hour WET test using fathead minnows (*Pimephales promelas*). Acute tests shall be conducted as a static replacement test using a single effluent grab sample. The permittee shall conduct each acute WET test in accordance with the 40 CFR Part 136 methods described in Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, Fifth Edition, October 2002 (EPA-821-R-02-012) or its most current edition.

ii) Acute WET Violations of the Permit Limit and Division Notification: An acute WET test is failed whenever the LC50, which represents an estimate of the effluent concentration which is lethal to 50% of the test organisms in the time period prescribed by the test, is found to be less than or equal to 100% effluent. The permittee must provide written notification of the failure of a WET test to the Division, along with a statement as to whether accelerated testing or a Toxicity Identification Evaluation (TIE) is being performed, unless otherwise exempted, in writing, by the Division. Notification must be received by the Division within 14 calendar days of the permittee receiving notice of the WET testing results.

iii) Automatic Compliance Response: The permittee is responsible for implementing the automatic compliance response provisions of this permit when one of the following occurs:

- there is a violation of the permit limit (the LC50 endpoint is less than the applicable IWC)
- the permittee is otherwise informed by the Division that a compliance response is necessary

When one of the above listed events occurs, the following automatic compliance response shall apply. The permittee shall either:

- conduct accelerated testing using the single species found to be more sensitive
- conduct a Toxicity Identification Evaluation / Toxicity Reduction Evaluation (TIE/TRE) investigation as described in Part I.C.7.a.iii.b.

a. Accelerated Testing

If accelerated testing is being performed, testing will be at least once every two weeks for up to five tests, at the appropriate IWC. Accelerated testing shall continue until; 1) two consecutive tests fail or three of five tests fail, in which case a pattern of toxicity has been demonstrated or 2) two consecutive tests pass or three of five tests pass, in which case no

pattern of toxicity has been found. Note that the same dilution series should be used in the accelerated testing as was used in the initial test(s) that result in the accelerated testing requirement.

If no pattern of toxicity is found the toxicity episode is considered to be ended and routine testing is to resume. If a pattern of toxicity is found, a TIE/TRE investigation is to be performed. If a pattern of toxicity is not demonstrated but a significant level of erratic toxicity is found, the Division may require an increased frequency of routine monitoring or some other modified approach. The permittee shall provide written notification of the results within 14 calendar days of completion of the Pattern of Toxicity/No Toxicity demonstration.

b. Toxicity Identification Evaluation / Toxicity Reduction Evaluation (TIE/TRE)—(applicable to both acute and chronic WET testing)

If a TIE/TRE is being performed, the results of the investigation are to be received by the Division within 180 days of the demonstration of acute WET in the routine test, as defined above, or if accelerated testing was performed, the date the pattern of toxicity is demonstrated. A status report is to be provided to the Division at the 60 and 120 day points of the TIE/TRE investigation. The Division may extend the time frame for investigation where reasonable justification exists. A request for an extension must be made in writing and received prior to the 180 day deadline. Such request must include a justification and supporting data for such an extension.

Under a TIE, the permittee may use the time for investigation to conduct a preliminary TIE (PTIE) or move directly into the TIE. A PTIE consists of a brief search for possible sources of WET, where a specific parameter(s) is reasonably suspected to have caused such toxicity, and could be identified more simply and cost effectively than a formal TIE. If the PTIE allows resolution of the WET incident, the TIE need not necessarily be conducted in its entirety. If, however, WET is not identified or resolved during the PTIE, the TIE must be conducted within the allowed 180 day time frame.

The Division recommends that the EPA guidance documents regarding TIEs be followed. If another method is to be used, this procedure should be submitted to the Division prior to initiating the TIE.

If the pollutant(s) causing toxicity is/are identified, and is/are controlled by a permit effluent limitation(s), this permit may be modified upon request to adjust permit requirements regarding the automatic compliance response.

If the pollutant(s) causing toxicity is/are identified, and is/are not controlled by a permit effluent limitation(s), the Division may develop limitations the parameter(s), and the permit may be reopened to include these limitations.

If the pollutant causing toxicity is not able to be identified, or is unable to be specifically identified, or is not able to be controlled by an effluent limit, the permittee will be required to perform either item 1 or item 2 below.

l) Conduct an investigation which demonstrates actual instream aquatic life conditions upstream and downstream of the discharge, or identify, for Division approval, and conduct an alternative investigation which demonstrates the actual instream impact. This

should include WET testing and chemical analyses of the ambient water. Depending on the results of the study, the permittee may also be required to identify the control program necessary to eliminate the toxicity and its cost. Data collected may be presented to the WQCC for consideration at the next appropriate triennial review of the stream standards;

2) Move to a TRE by identifying the necessary control program or activity and proceed with elimination of the toxicity so as to meet the WET effluent limit.

If toxicity spontaneously disappears in the midst of a TIE, the permittee shall notify the Division within 10 days of such disappearance. The Division may require the permittee to conduct accelerated testing to demonstrate that no pattern of toxicity exists, or may amend the permit to require an increased frequency of WET testing for some period of time. If no pattern of toxicity is demonstrated through the accelerated testing or the increased monitoring frequency, the toxicity incident response will be closed and normal WET testing shall resume.

The control program developed during a TRE consists of the measures determined to be the most feasible to eliminate WET. This may happen through the identification of the toxicant(s) and then a control program aimed specifically at that toxicant(s) or through the identification of more general toxicant treatability processes. A control program is to be developed and submitted to the Division within 180 days of beginning a TRE. Status reports on the TRE are to be provided to the Division at the 60 and 120 day points of the TRE investigation.

If toxicity spontaneously disappears in the midst of a TRE, the permittee shall notify the Division within 10 days of such disappearance. The Division may require the permittee to conduct accelerated testing to demonstrate that no pattern of toxicity exists, or may amend the permit to require an increased frequency for some period of time. If no pattern of toxicity is demonstrated through the accelerated testing or the increased monitoring frequency, the toxicity incident response will be closed and normal WET testing shall resume.

iv) Toxicity Reopener (applicable to both acute and chronic WET testing): This permit may be reopened and modified to include additional or modified numerical permit limitations, new or modified compliance response requirements, changes in the WET testing protocol, the addition of both acute and chronic WET requirements, or any other conditions related to the control of toxicants.

b. Chronic WET Testing

i) General Chronic WET Testing and Reporting Requirements: The permittee shall conduct the chronic WET test using Ceriodaphnia dubia and fathead minnows (*Pimephales promelas*), as a static renewal 7-day test using three separate grab samples. The permittee shall conduct each chronic WET test in accordance with the 40 CFR Part 136 methods described in Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, Fourth Edition, October 2002 (EPA-821-R-02-013) or the most current edition, except as modified by the most current Division Guidance document entitled Guidelines for Conducting Whole Effluent Toxicity Tests.

ii) Chronic WET Violations of the Permit Limit, Failure of One Test Statistical Endpoint and Division Notification:

A chronic WET test is considered a violation of a permit limitation when both the NOEC and the IC25 are at any effluent concentration less than the IWC. **The IWC for this permit has been determined to be 100% effluent.** The permit applicant will need to apply for an individual permit for consideration of a lower IWC percentage.

A chronic WET test is considered to have failed one of the two statistical endpoints when either the NOEC or the IC25 are at any effluent concentration less than the IWC. **The IWC for this permit has been determined to be 100% effluent.** The permit applicant will need to apply for an individual permit for consideration of a lower IWC percentage.

In the event of a permit violation, or when two consecutive reporting periods have resulted in failure of one of the two statistical endpoints (regardless of which statistical endpoints are failed), the permittee must provide written notification to the Division. Such notification should explain whether it was a violation or two consecutive failures of a single endpoint, and must indicate whether accelerated testing or a Toxicity Identification Evaluation or Toxicity Reduction Evaluation (TIE or TRE) is being performed, unless otherwise exempted, in writing, by the Division. Notification must be received by the Division within 14 calendar days of the permittee receiving notice of the WET testing results.

iii) Automatic Compliance Response: The permittee is responsible for implementing the automatic compliance response provisions of this permit when one of the following occurs:

- there is a violation of the permit limit (both the NOEC and the IC25 endpoints are less than the applicable IWC)
- two consecutive monitoring periods have resulted in failure of one of the two statistical endpoints (either the IC25 or the NOEC)
- the permittee is otherwise informed by the Division that a compliance response is necessary

When one of the above listed events occurs, the following automatic compliance response shall apply. The permittee shall either:

- conduct accelerated testing using the single species found to be more sensitive
- conduct a Toxicity Identification Evaluation / Toxicity Reduction Evaluation (TIE/TRE) investigation as described in Part I.C.7.b.iii.b.

a. Accelerated Testing

If accelerated testing is being performed, testing will be at least once every two weeks for up to five tests, using only the IC25 statistical endpoint to determine if the test passed or failed at the appropriate IWC. Accelerated testing shall continue until; 1) two consecutive tests fail or three of five tests fail, in which case a pattern of toxicity has been demonstrated or 2) two consecutive tests pass or three of five tests pass, in which case no pattern of toxicity has been found. Note that the same dilution series should be used in the accelerated testing as was used in the initial test(s) that result in the accelerated testing requirement.

If accelerated testing is required due to failure of one statistical endpoint in two consecutive monitoring periods, and in both of those failures it was the NOEC endpoint that was failed, then the NOEC shall be the only statistical endpoint used to determined whether the

accelerated testing passed or failed at the appropriate IWC. Note that the same dilution series should be used in the accelerated testing as was used in the initial test(s) that result in the accelerated testing requirement.

If no pattern of toxicity is found the toxicity episode is considered to be ended and routine testing is to resume. If a pattern of toxicity is found, a TIE/TRE investigation is to be performed. If a pattern of toxicity is not demonstrated but a significant level of erratic toxicity is found, the Division may require an increased frequency of routine monitoring or some other modified approach. The permittee shall provide written notification of the results within 14 calendar days of completion of the Pattern of Toxicity/No Toxicity demonstration.

b. Toxicity Identification Evaluation / Toxicity Reduction Evaluation (TIE/TRE)—See Section C.7.a.iii.b for TIE/TRE Requirements

iv) Toxicity Reopener—See Section C.7.a.iv for Toxicity Reopener Requirements.

8. Chemical Additions

No chemicals are to be added that have the potential to be present in the permitted discharge, including, but not limited to, chemical additions at any point in the treatment process, unless the Division grants permission for the use of the specific chemical(s). The permit applicant must submit a list of proposed chemicals, including dosage rates, used in the treatment process. Additionally, a MSDS for each chemical proposed for use must be provided. In granting the use of such chemicals, additional limitations and monitoring requirements may be imposed.

Chemicals used in waters that will or may be discharged to waters of the State must be used in accordance with all state and federal regulations, and in strict accordance with the manufacturer's site-specific instructions.

9. Discharge Point

All waters shall be discharged in a manner to prevent erosion, scouring, or damage to stream banks, streambeds, or ditches.

10. Discharges to Conveyances

All dischargers must comply with the lawful requirements of counties; drainage districts and other state or local agencies regarding any discharges to storm drain systems or other watercourses under their jurisdiction.

11. Mixing Zone

For this general permit, all numeric effluent limitations are assigned as end of pipe limits based on the Water Quality Standards. Dilution (i.e. mixing zone) considerations are not applicable in this permit. Dischargers who want consideration of a mixing allowance should apply for an individual permit

12. Discharges to Waters with Total Maximum Daily Loads (TMDLs)

Discharges to State waters for which an approved or established TMDL has been developed may be authorized provided there are sufficient remaining wasteload allocations in the approved or established TMDL. If sufficient remaining wasteload allocations are not available, coverage under an Individual permit may be required. Additional effluent limitations or other terms and conditions may be imposed for discharges to segments for which a TMDL has been completed. The determination whether compliance with numeric effluent limitations will be required will be made on case-by-case basis. Factors that will be taken into consideration when making this determination include the plausibility that the pollutant for which the TMDL was developed will be in the discharge, and duration and frequency of the discharge.

13. Discharges to 303(d) Listed Waters

Sampling, monitoring and compliance with numeric effluent limitations may be required for discharges to 303(d) listed waters that are impaired for the specified pollutant(s). The determination whether compliance with the numeric effluent limitation will be required will be made on case-by-case basis. Factors that will be taken into consideration when making this determination include the plausibility that the pollutant listed on the 303(d) list will be in the discharge, and duration and frequency of the discharge.

D. DEFINITIONS OF TERMS

1. "Acute Toxicity" - The acute toxicity limitation is exceeded if the LC50 is at any effluent concentration less than or equal to the IWC indicated in this permit.

2. "Antidegradation (AD)" means waters designated as reviewable (or undesignated water) must be maintained and protected at their existing water quality unless a determination is made that degrading water quality is necessary. These waters have water quality that is, in general, better than the water quality standards and is to be maintained and protected. The AD review applies only to activities with new or increased water quality impacts. Additional AD information can be found in Section 31.8 of The Basic Standards and Methodolgies for Surface Water.

3. "Chronic toxicity", which includes lethality and growth or reproduction, occurs when the NOEC and IC25 are at an effluent concentration less than the IWC indicated in this permit.

4. "Composite" sample is a minimum of four (4) grab samples collected at equally spaced two (2) hour intervals and proportioned according to flow. For intermittent discharges or discharges lasting less than 8 hours, a composite sample is defined as sampling three (3) equal aliquots during the beginning, middle and end of the discharge period.

5. "Continuous" measurement is a measurement obtained from an automatic recording device which continually measures provides measurements.

6. "Daily Maximum limitation" for all parameters except temperature, means the limitation for this parameter shall be applied as an instantaneous maximum (or, for pH or DO, instantaneous minimum) value. The instantaneous value is defined as the analytical result of any individual sample. DMRs shall include the maximum (and/or minimum) of all instantaneous values within the calendar month. Any instantaneous value beyond the noted daily maximum limitation for the indicated parameter shall be considered a violation of this permit.

7. " Daily Maximum Temperature (DM)" is defined in the Basic Standards and Methodologies for Surface Water 1002-31, as the highest two-hour average water temperature recorded during a given 24-hour period. This will be determined using a rolling 2-hour maximum temperature. If data is collected every 15 minutes, a 2 hour maximum can be determined on every data point after the initial 2 hours of collection. Note that the time periods that overlap days (Wednesday night to Thursday morning) do not matter as the reported value on the DMR is the greatest of all the 2-hour averages.

   For example data points collected at:
   08:15, 08:30, 08:45, 09:00, 09:15, 09:30, 09:45, 10:00, would be averaged for a single 2 hour average data point
   08:30, 08:45, 09:00, 09:15, 09:30, 09:45, 10:00, 10:15, would be averaged for a single 2 hour average data point
   08:45, 09:00, 09:15, 09:30, 09:45, 10:00, 10:15, 10:30, would be averaged for a single 2 hour average data point

This would continue throughout the course of a calendar day. The highest of these 2 hour averages over a month would be reported on the DMR as the daily maximum temperature. At the end/beginning of a month, the collected data should be used for the month that contains the greatest number of minutes in the 2-hour maximum.

Data from 11 pm to 12:59 am, would fall in the previous day. Data collected from 11:01 pm to 1:00 am would fall in the new month.

8. "Dissolved (D) metals fraction" is defined in the Basic Standards and Methodologies for Surface Water 1002-31, as that portion of a water and suspended sediment sample which passed through a 0.40 or 0.45 UM (micron) membrane filter. Determinations of "dissolved" constituents are made using the filtrate. This may include some very small (colloidal) suspended particles which passed through the membrane filter as well as the amount of substance present in true chemical solution.

9. "Geometric mean" for *E. coli* bacteria concentrations, the thirty (30) day and seven (7) day averages shall be determined as the geometric mean of all samples collected in a thirty (30) day period and the geometric mean of all samples taken in a seven (7) consecutive day period respectively. The geometric mean may be calculated using two different methods. For the methods shown, a, b, c, d, etc. are individual sample results, and n is the total number of samples.

   Method 1:

   Geometric Mean = $(a*b*c*d*...)^{(1/n)}$ "*" - means multiply

   Method 2:

   Geometric Mean = antilog ([log(a)+log(b)+log(c)+log(d)+...]/n)

   Graphical methods, even though they may also employ the use of logarithms, may introduce significant error and may not be used.

   In calculating the geometric mean, for those individual sample results that are reported by the analytical laboratory to be "less than" a numeric value, a value of 1 should be used in the calculations. If all individual analytical results for the month are reported to be less than numeric values, then report "less than" the largest of those numeric values on the monthly DMR. Otherwise, report the calculated value.

   For any individual analytical result of "too numerous to count" (TNTC), that analysis shall be considered to be invalid and another sample shall be promptly collected for analysis. If another sample cannot be collected within the same sampling period for which the invalid sample was collected (during the same month if monthly sampling is required, during the same week if weekly sampling is required, etc.), then the following procedures apply:

   i. A minimum of two samples shall be collected for coliform analysis within the next sampling period.

   ii. If the sampling frequency is monthly or less frequent: For the period with the invalid sample results, leave the spaces on the corresponding DMR for reporting coliform results empty and attach to the DMR a letter noting that a result of TNTC was obtained for that period, and explain why another sample for that period had not been collected.

If the sampling frequency is more frequent than monthly: Eliminate the result of TNTC from any further calculations, and use all the other results obtained within that month for reporting purposes. Attach a letter noting that a result of TNTC was obtained, and list all individual analytical results and corresponding sampling dates for that month.

10. "Grab" sample, is a single "dip and take" sample so as to be representative of the parameter being monitored.

11. "In-situ" measurement is defined as a single reading, observation or measurement taken in the field at the point of discharge.

12. "Instantaneous" measurement is a single reading, observation, or measurement performed on site using existing monitoring facilities.

13. To be considered an "Intermittent Discharge" one of the following must apply:
    A) the maximum discharge frequency is less than 3 consecutive days (72 hours), and less than 3 days per 7 day period, and less than 10 days total per month

    B) the maximum discharge frequency is less than 5 consecutive days (120 hours) and less than 5 total days per month

    C) It can be shown that discharge frequency and duration is tied solely to precipitation events, where the discharge starts and stops shortly after the precipitation event starts/stops.

14. "Material handling activities" include: storage, loading and unloading of any raw material, intermediate product, finished product, by-product, or waste product where such products could come in contact with precipitation.

15. "Maximum Weekly Average Temperature (MWAT)" is defined in the Basic Standards and Methodologies for Surface Water 1002-31, as an implementation statistic that is calculated from field monitoring data. The MWAT is calculated as the largest mathematical mean of multiple, equally spaced, daily temperatures over a seven-day consecutive period, with a minimum of three data points spaced equally through the day. For lakes and reservoirs, the MWAT is assumed to be equivalent to the maximum WAT from at least three profiles distributed throughout the growing season (generally July-September).

    The MWAT is calculated by averaging all temperature data points collected during a calendar day, and then averaging the daily average temperatures for 7 consecutive days. This 7 day averaging period is a rolling average, i.e. on the 8th day, the MWAT will be the averages of the daily averages of days 2-8. The value to be reported on the DMR is the highest of all the rolling 7-day averages throughout the month. For those days that are at the end/beginning of the month, the data shall be reported for the month that contains 4 of the 7 days.

    Day 1: Average of all temperature data collected during the calendar day.
    Day 2: Average of all temperature data collected during the calendar day.
    Day 3: Average of all temperature data collected during the calendar day.
    Day 4: Average of all temperature data collected during the calendar day.
    Day 5: Average of all temperature data collected during the calendar day.
    Day 6: Average of all temperature data collected during the calendar day.
    Day 7: Average of all temperature data collected during the calendar day.
    1st MWAT Calculation as average of previous 7 days
    Day 8: Average of all temperature data collected during the calendar day.
    2nd MWAT Calculation as average of previous 7 days
    Day 9: Average of all temperature data collected during the calendar day.
    3rd MWAT Calculation as average of previous 7 days

16. "Metals Screen" means an analysis using an EPA approved method found in 40 CFR Part 136, and with an analyte list which includes all metals found in the Influent Screening Requirements found in Part III of the permit. The metals analyses must be performed for the extraction (Total Recoverable, Potentially Dissolved, Dissolved form) identified in Part III of the permit.

17. "Potentially dissolved (PD) metals fraction" is defined in the Basic Standards and Methodologies for Surface Water 1002-31, as that portion of a constituent measured from the filtrate of a water and suspended sediment sample that was first treated with nitric acid to a pH of 2 or less and let stand for 8 to 96 hours prior to sample filtration using a 0.40 or 0.45-UM (micron) membrane filter. Note the "potentially dissolved" method cannot be used where nitric acid will interfere with the analytical procedure used for the constituent measured.

18. "Practical Quantitation Limit (PQL)" means the minimum concentration of an analyte (substance) that can be measured with a high degree of confidence that the analyte is present at or above that concentration. The use of PQL in this document may refer to those PQLs shown in Part I.D of this permit or the PQLs of an individual laboratory.

19. "Quarterly measurement frequency" means samples may be collected at any time during the calendar quarter if a continual discharge occurs. If the discharge is intermittent, then samples shall be collected anytime during the quarter that the discharge occurs. Calendar quarters are defined as January-March, April-June, July-September, and October-December.

20. "Recorder" requires the continuous operation of a chart and/or totalizer (or drinking water rotor meters or pump hour meters where previously approved.)

21. "Semi-Volatile Organic Screen" means an analysis using an EPA approved method found in 40 CFR part 136, and with an analyte list which includes the base, neutral, acid, dioxane organic compounds listed in the Influent Screening Requirements found in Part III of the permit. Pesticides, herbicides, and PCBs do not need to be included in this analysis.

22. "Seven (7) day average" means, with the exception of fecal coliform or *E. coli* bacteria (see geometric mean), the arithmetic mean of all samples collected in a seven (7) consecutive day period. Such seven (7) day averages shall be calculated for all calendar weeks, which are defined as beginning on Sunday and ending on Saturday. If the calendar week overlaps two months (i.e. the Sunday is in one month and the Saturday in the following month), the seven (7) day average calculated for that calendar week shall be associated with the month that contains the Saturday. Samples may not be used for more than one (1) reporting period. **(See the "Analytical and Sampling Methods for Monitoring and Reporting Section in Part I.E.3 for guidance on calculating averages and reporting analytical results that are less than the PQL).**

23. "Significant materials" include but are not limited to: raw materials; fuels; materials such as metallic products; hazardous substances designated under section 101(14) of CERCLA; any chemical the facility is required to report pursuant to section 313 of SARA III; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with stormwater discharge.

24. "State Waters" means any and all surface or subsurface waters which are contained in or flow in or through this state, but does not include waters in sewage systems, waters in treatment works of disposal systems, waters in potable water distribution systems, and all water withdrawn for use until use and treatment have been completed.

25. "State Surface Waters" means all surface waters that meet the definition of "State Waters," including ground

water that is hydrologically connected to surface water.

26. "Thirty (30) day average" means, except for fecal coliform or *E. coli* bacteria (see geometric mean), the arithmetic mean of all samples collected during a thirty (30) consecutive-day period. The permittee shall report the appropriate mean of all self-monitoring sample data collected during the calendar month on the Discharge Monitoring Reports. Samples shall not be used for more than one (1) reporting period. **(See the "Analytical and Sampling Methods for Monitoring and Reporting Section in Part I.E.3 for guidance on calculating averages and reporting analytical results that are less than the PQL).**

27. "Total Metals" means the concentration of metals determined on an unfiltered sample following vigorous digestion (Section 4.1.3), or the sum of the concentrations of metals in both the dissolved and suspended fractions, as described in Manual of Methods for Chemical Analysis of Water and Waste*s*, U.S. Environmental Protection Agency, March 1979, or its equivalent.

28. "Total Recoverable Metals" means that portion of a water and suspended sediment sample measured by the total recoverable analytical procedure described in Methods for Chemical Analysis of Water and Wastes, U.S. Environmental Protection Agency, March 1979 or its equivalent.

29. "Twenty four (24) hour composite" sample is a combination of at least eight (8) sample aliquots of at least 100 milliliters, collected at equally spaced intervals during the operating hours of a facility over a twenty-four (24) hour period. For volatile pollutants, aliquots must be combined in the laboratory immediately before analysis. The composite must be flow proportional; either the time interval between each aliquot or the volume of each aliquot must be proportional to either the wastewater or effluent flow at the time of sampling or the total wastewater or effluent flow since the collection of the previous aliquot. Aliquots may be collected manually or automatically.

30. "Twice Monthly" monitoring frequency means that two samples shall be collected each calendar month on separate weeks with at least one full week between the two sample dates. Also, there shall be at least one full week between the second sample of a month and the first sample of the following month.

31. "Visual" observation is observing the discharge to check for the presence of a visible sheen or floating oil.

32. "Volatile Organic Compound Screen" means an analysis using an EPA approved method found in 40 CFR part 136, and with an analyte list which includes the volatile organic compounds listed in the Influent Screening Requirements found in Part III of the permit.

33. "Water Quality Control Division" or "Division" means the state Water Quality Control Division as established in 25-8-101 et al.)

34. "Weekly measurement frequency" means samples may be collected at any time during the week as defined as beginning on Sunday and ending on Saturday. If the discharge is intermittent, a sample must be collected for each week (as defined above) that the discharge occurs. A minimum of one sample must be collected for discharges lasting less than one week. For example, if an intermittent discharge begins on Wednesday, February 2nd and ends on Friday, February 4th, one sample must collected on the 2nd, 3rd, or 4th. If the discharge resumes on Sunday, February 13 and is intermittent through Monday, February 14th an additional sample must be collected on the 13th or the 14th.

E. GENERAL MONITORING, SAMPLING AND REPORTING REQUIREMENTS

1. Routine Reporting of Data

Reporting of data gathered in compliance with Part I.B.2 shall be on a **monthly** basis. Reporting of all data gathered shall comply with the requirements of Part I.E. (General Requirements). Monitoring results shall be summarized for each calendar month and reported on Division approved discharge monitoring report (DMR) forms (EPA form 3320-1).

The permittee must submit these forms either by mail, or by using the Division's Net-DMR services (when available). DMRs must be received by the Division no later than the 28th day of the month following the monitoring period (for example, the DMR for the first calendar quarter must be received by the Division by April 28th). If no discharge occurs during the reporting period, "No Discharge" shall be reported on the DMR.

If being mailed, the original signed copy of each discharge monitoring report (DMR) shall be submitted to the Division at the following address:

Colorado Department of Public Health and Environment
Water Quality Control Division
WQCD-P-B2
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

The Discharge Monitoring Report forms shall be filled out accurately and completely in accordance with requirements of this permit and the instructions on the forms. They shall be signed by an authorized person as identified in Part I.E.7.

2. Representative Sampling

Discharge points shall be designed or modified so that a sample of the effluent can be obtained at a point after the final treatment process and prior to discharge to state waters. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to and approval by the Division. The permittee shall provide access to the Division to sample the discharge at these points.

3. Analytical and Sampling Methods for Monitoring and Reporting

The permittee shall install, calibrate, use and maintain monitoring methods and equipment, including biological and indicated pollutant monitoring methods. All sampling shall be performed by the permittee according to specified methods in 40 C.F.R. Part 136; methods approved by EPA pursuant to 40 C.F.R. Part 136; or methods approved by the Division, in the absence of a method specified in or approved pursuant to 40 C.F.R. Part 136 (see text below for specifics on nonylphenol monitoring).

If the permit contains a numeric effluent limit for a parameter, the analytical method and PQL selected for all monitoring conducted in accordance with this permit for that parameter shall be the one that can measure at or below the numeric effluent limit. If all specified analytical methods and corresponding PQLs are greater than the numeric effluent limit, then the analytical method with the lowest PQL shall be used.

If the permit contains a report only requirement for a parameter, the analytical method and PQL chosen shall be one that can measure at or below the potential numeric effluent limit(s). If all analytical methods and corresponding PQLs are greater than the potential numeric effluent limit(s), then the analytical method with the lowest PQL shall be used.

If the permit contains an interim effluent limitation (a limit is report until such time as a numeric effluent limit becomes effective) for a parameter, the analytical method and PQL chosen for all monitoring conducted in accordance with this permit for the parameter shall be one that can measure to the final numeric effluent limit. If all analytical methods and corresponding PQLs are greater than the final numeric effluent limit(s), then the analytical method with the lowest PQL shall be used.

For parameters such as TIN, the analytical methods chosen shall be those that can measure to the potential or final numeric effluent limit, based on the sum of the PQLs for nitrate, nitrite and ammonia.

When the analytical method which complies with the above requirements has a PQL greater than the permit limit, and the permittee's analytical result is less than the PQL, the permittee shall report "BDL" on the DMR. Such reports will not be considered as violations of the permit limit, as long as the lowest available PQL is used for the analysis. When the analytical method which complies with the above requirements has a PQL that is equal to or less than the permit limitation, and the permittee's analytical result is less than the PQL, "< X" (where X = the actual PQL achieved by the laboratory) shall be reported on the DMR. For parameters that have a report only limitation, and the permittee's analytical result is less than the PQL, "< X" (where X = the actual PQL achieved by the laboratory) shall be reported on the DMR.

In the calculation of average concentrations (i.e. 7- day average, 30-day average, 2-year rolling average) any individual analytical result that is less than the PQL shall be considered to be zero for the calculation purposes. When reporting:

If all individual analytical results are less than the PQL, the permittee shall report either "BDL" or "<X" (where X = the actual PQL achieved by the laboratory), following the guidance above.

If one or more individual results is greater than the PQL, an average shall be calculated and reported. Note that it does not matter if the final calculated average is greater or less than the PQL, it must be reported as a value.

Note that when calculating T.I.N. for a single sampling event, any value less than the PQL (for total ammonia, total nitrite, or total nitrate) shall be treated as zero. The T.I.N. concentration for a single sampling event shall then be determined as the sum of the analytical results (zeros if applicable) of same day sampling for total ammonia and total nitrite and total nitrate. From these calculated T.I.N. concentrations, the daily maximum and thirty day average concentrations shall be calculated and must be reported as a value.

The present lowest PQLs for specific parameters, as determined by the State Laboratory (November 2008) are provided below. If the analytical method cannot achieve a PQL that is less than or equal to the permit limit, then the method, or a more precise method, must achieve a PQL that is less than or equal to the PQL in the table below. A listing of the PQLs for organic parameters that must meet the above requirement can be found in the Division's Practical Quantitation Limitation Guidance Document, July 2008.

For nonylphenol, until such time as there is an EPA 40 CFR Part 136 method, the State is approving use of ASTM Methods D7065 and D7485. Until a statewide PQL has been developed, the permittee shall use either the default PQLs listed in the table below, or develop their own site-specific PQL in accordance with the Practical Quantitation Limitation Guidance Document (July 2008) for Organic Parameters. This document is available on the Division's website at www.coloradowaterpermits.com . The delayed effective date for the monitoring requirement allows time for the permittee to develop a site-specific PQL.

For hexavalent chromium, samples must be unacidified so dissolved concentrations will be measured rather than potentially dissolved concentrations.

Parameter	Practical Quantitation Limits,	Parameter	Practical Quantitation Limits, µg/l
Aluminum	50 µg/l	Manganese	2 µg/l
Ammonia	1 mg/l	Mercury	0.1 µg/l
Arsenic	1 µg/l	Mercury (low-level)	0.003 µg/l
Barium	5 µg/l	Nickel	50 µg/l
Beryllium	1 µg/l	N-Ammonia	50 µg/l
BOD / CBOD	1 mg/l	N Nitrate/Nitrite	0.5 mg/l
Boron	50 µg/l	N-Nitrate	50 µg/l
Cadmium	1 µg/l	N-Nitrite	10 µg/l
Calcium	20 µg/l	Total Nitrogen	0.5 mg/l
Chloride	2 mg/l	Phenols	100 µg/l
Chlorine	0.1 mg/l	Phosphorus	10 µg/l
Total Residual Chlorine		Radium 226	1 pCi/l
DPD colorimetric	0.10 mg/l	Radium 228	1 pCi/l
Amperometric titration	0.05 mg/l	Selenium	1 µg/l
Chromium	20 µg/l	Silver	0.5 µg/l
Chromium, Hexavalent	20 µg/l	Sodium	0.2 mg/l
Copper	5 µg/l	Sulfate	5 mg/l
Cyanide (Direct / Distilled)	10 µg/l	Sulfide	0.2 mg/l
Cyanide, WAD+A47	5 µg/l	Total Dissolved Solids	10 mg/l
Fluoride	0.1 mg/l	Total Suspended Solids	10 mg/l
Iron	10 µg/l	Thallium	1 µg/l
Lead	1 µg/l	Uranium	1 µg/l
Magnesium	20 µg/l	Zinc	10 µg/l

4. Records

The permittee shall establish and maintain records. The records shall include the following:

a. The date, type, exact location, and time of sampling or measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) the analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used;
f. The results of such analyses; and
g. Any other observations which may result in an impact on the quality or quantity of the discharge as indicated in 40 CFR 122.44 (i)(1)(iii).

The permittee shall retain for the duration of permit coverage or a minimum of three (3) years (whichever is greater) records of all monitoring information, including all original strip chart recordings for continuous monitoring instrumentation, all calibration and maintenance records, laboratory data sheets, copies of all reports required by this permit and records of all data used to complete the application for this permit. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the permittee or when requested by the Division or EPA. These records must be retained at the facility during

active treatment. Once active treatment is complete, the records shall be maintained and made available at the request of the Division.

5. Additional Monitoring by Permittee

If the permittee, using the approved analytical methods, monitors any parameter more frequently than required by this permit, then the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form or other forms as required by the Division. Such increased frequency shall also be indicated.

6. Flow Measuring Device

If not already a part of the permitted facility, within ninety (90) days after the effective date of the permit, a flow measuring device shall be installed to give representative values of effluent quantities at the respective discharge point(s). Unless specifically exempted, or modified in the permit certification, a flow measuring device will be applicable at all designated discharge points.

At the request of the Division, the permittee shall show proof of the accuracy of any flow-measuring device used in obtaining data submitted in the monitoring report. The flow-measuring device must indicate values within ten (10) percent of the actual flow being discharged from the facility.

7. Signatory and Certification Requirements

a. All applications must be signed and certified for accuracy as follows:

(i) In the case of corporations, by a responsible corporate officer. For purposes of this section, the responsible corporate officer is responsible for the overall operation of the facility from which the discharge described in the form originates;

(ii) In the case of partnership, by a general partner;

(iii) In the case of a sole proprietorship, by the proprietor;

(iv) In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer has responsibility for the overall operation of the facility from which the discharge originates.

b. All reports and other information required by the Division, shall be signed and certified for accuracy by the permittee in accord with the following criteria:

i) In the case of corporations, by a responsible corporate officer. For purposes of this section, the responsible corporate officer is responsible for the overall operation of the facility from which the discharge described in the form originates;

ii) In the case of a partnership, by a general partner;

iii) In the case of a sole proprietorship, by the proprietor;

iv) In the case of a municipal, state, or other public facility, by either a principal executive officer, or ranking elected official. For purposes of this section, a principal executive officer has responsibility for the overall operation of the facility from which the discharge originates;

v) By a duly authorized representative of a person described above, only if:

1) The authorization is made in writing by a person described in i, ii, iii, or iv above;

2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and,

3) The written authorization is submitted to the Division.

c. If an authorization as described in this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

The permittee, or the duly authorized representative shall make and sign the following certification on all such documents:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

PART II

A. NOTIFICATION REQUIREMENTS

1. Notification to Parties

All notification requirements under this section shall be directed as follows:

a. Oral Notifications, during normal business hours shall be to:

Water Quality Protection Section - Industrial Compliance Program
Water Quality Control Division
Telephone: (303) 692-3500

b. Written notification shall be to:

Water Quality Protection Section - Industrial Compliance Program
Water Quality Control Division
Colorado Department of Public Health and Environment
WQCD-WQP-B2
4300 Cherry Creek Drive South
Denver, CO 80246-1530

2. Change in Discharge or Wastewater Treatment

The permittee shall notify the Division in writing, of any planned physical alterations or additions to the permitted facility, to include the treatment process. Notice is required when:

a. The alteration or addition is likely to result in a new or altered discharge either in terms of location or effluent quality prior to the occurrence of the new or altered discharge, or;

b. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported pursuant to an approved land application plan.

The permittee shall give advance notice to the Division of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. For any pollutant for which monitoring requirements are not included in the permit certification, the permittee shall notify the Division as soon as it becomes aware that the pollutant(s) are present in the source water, influent, or effluent in concentrations greater than originally identified in the application.

Whenever notification of any planned physical alterations or additions to the permitted facility is required pursuant to this section, the permittee shall furnish the Division such plans and specifications which the Division deems reasonably necessary to evaluate the effect on the discharge, the stream, or ground water.

If the Division finds that such new or altered discharge might be inconsistent with the conditions of the permit, the Division shall require a new or revised permit application and shall follow the procedures specified in Sections 61.5 through 61.6, and 61.15 of the Colorado Discharge Permit System Regulations.

3. Special Notifications - Definitions

a. Bypass: The intentional diversion of waste streams from any portion of a treatment facility.

b. Severe Property Damage: Substantial physical damage to property at the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. It does not mean economic loss caused by delays in production.

c. Upset: An exceptional incident in which there is unintentional and temporary noncompliance with permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

4. Noncompliance Notification

a. If, for any reason, the permittee does not comply with or will be unable to comply with any discharge limitations or standards specified in this permit, the permittee shall, at a minimum, provide the Division and EPA with the following information:

i) A description of the discharge and cause of noncompliance;

ii) The period of noncompliance, including exact dates and times and/or the anticipated time when the discharge will return to compliance; and

iii) Steps being taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

b. The permittee shall report the following circumstances **orally within twenty-four (24) hours** from the time the permittee becomes aware of the circumstances, and shall mail to the Division a written report containing the information requested in Part II.A.4 (a) **within five (5) days** after becoming aware of the following circumstances:

   i) Circumstances leading to any noncompliance which may endanger health or the environment regardless of the cause of the incident;

   ii) Circumstances leading to any unanticipated bypass which exceeds any effluent limitations in the permit;

   iii) Circumstances leading to any upset which causes an exceedance of any effluent limitation in the permit;

   iv) Daily maximum violations for any of the pollutants limited by Part I.A of this permit and specified as requiring 24-hour notification. This includes any toxic pollutant or hazardous substance or any pollutant specifically identified as the method to control any toxic pollutant or hazardous substance.

c. Unless otherwise indicated in this permit, the permittee shall report instances of non-compliance which are not required to be reported within 24-hours at the time Discharge Monitoring Reports are submitted. The reports shall contain the information listed in sub-paragraph (a) of this section.

5. Other Notification Requirements

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule in the permit shall be submitted no later than fourteen (14) days following each scheduled date, unless otherwise provided by the Division.

The permittee shall notify the Division, in writing, thirty (30) days in advance of a proposed transfer of permit as provided in Part II.B.3.

The permittee's notification of all anticipated noncompliance does not stay any permit condition.

All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Division as soon as they know or have reason to believe:

a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

   i) One hundred micrograms per liter (100 µg/l);

   ii) Two hundred micrograms per liter (200 µg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/l) for 2.4-dinitrophenol and 2-methyl-4.6-dinitrophenol; and one milligram per liter (1.0 mg/l) for antimony;

   iii) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with Section 61.4(2)(g).

iv) The level established by the Division in accordance with 40 C.F.R. § 122.44(f).

b. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

i) Five hundred micrograms per liter (500 µg/l);

ii) One milligram per liter (1 mg/l) for antimony; and

iii) Ten (10) times the maximum concentration value reported for that pollutant in the permit application.

iv) The level established by the Division in accordance with 40 C.F.R. § 122.44(f).

6. Bypass Notification

If the permittee knows in advance of the need for a bypass, a notice shall be submitted, at least ten days before the date of the bypass, to the Division. The bypass shall be subject to Division approval and limitations imposed by the Division. Violations of requirements imposed by the Division will constitute a violation of this permit.

7. Upsets

a. Effect of an Upset

An upset constitutes an affirmative defense to an action brought for noncompliance with permit effluent limitations if the requirements of paragraph (b) of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

b. Conditions Necessary for a Demonstration of Upset

A permittee who wishes to establish the affirmative defense of upset shall demonstrate through properly signed contemporaneous operating logs, or other relevant evidence that:

i) An upset occurred and that the permittee can identify the specific cause(s) of the upset; and

ii) The permitted facility was at the time being properly operated and maintained; and

iii) The permittee submitted proper notice of the upset as required in Part II.A.4. of this permit (24-hour notice); and

iv) The permittee complied with any remedial measure necessary to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reason able likelihood of adversely affecting human health or the environment.

In addition to the demonstration required above, a permittee who wishes to establish the affirmative defense of upset for a violation of effluent limitations based upon water quality standards shall also demonstrate through monitoring, modeling or other methods that the relevant standards were achieved in the receiving water.

c. Burden of Proof

In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

8. Discharge Point

Any discharge to the waters of the State from a point source other than specifically authorized by this permit is prohibited.

9. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee as necessary to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance and adequate laboratory and process controls, including appropriate quality assurance procedures (40 CFR 122.41(e)). This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when necessary to achieve compliance with the conditions of the permit.

10. Minimization of Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any discharge of sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. As necessary, accelerated or additional monitoring to determine the nature and impact of the noncomplying discharge is required.

11. Removed Substances

Solids, sludges, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in accordance with applicable state and federal regulations and in a manner that will prevent the removed pollutant(s) from entering waters of the State.

For all domestic wastewater treatment works, at industrial facilities, the permittee shall dispose of sludge in accordance with all State and Federal regulations.

12. Submission of Incorrect or Incomplete Information

Where the permittee failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or report to the Division, the permittee shall promptly submit the relevant information which was not submitted or any additional information needed to correct any erroneous information previously submitted.

13. Bypass

a. Bypasses are prohibited and the Division may take enforcement action against the permittee for bypass, unless:

   i) The bypass is unavoidable to prevent loss of life, personal injury, or severe property damage;

   ii) There were no feasible alternatives to bypass such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

   iii) Proper notices were submitted in compliance with Part II.A.4.

b. "Severe property damage" as used in this Subsection means substantial physical damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources

which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

c. The permittee may allow a bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance or to assure optimal operation. These bypasses are not subject to the provisions of paragraph (a) above.

d. The Division may approve an anticipated bypass, after considering adverse effects, if the Division determines that the bypass will meet the conditions specified in paragraph (a) above.

14. <u>Reduction, Loss, or Failure of Treatment Facility</u>

The permittee has the duty to halt or reduce any activity if necessary to maintain compliance with the effluent limitations of the permit. Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production, control sources of wastewater, or all discharges, until the facility is restored or an alternative method of treatment is provided. This provision also applies to power failures, unless an alternative power source sufficient to operate the wastewater control facilities is provided.

It shall not be a defense for a permittee in an enforcement action that it would be necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

B. RESPONSIBILITIES

1. **Inspections and Right to Entry**
The permittee shall allow the Division and/or the authorized representative, upon the presentation of credentials:

   a. To enter upon the permittee's premises where a regulated facility or activity is located or in which any records are required to be kept under the terms and conditions of this permit;

   b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit and to inspect any monitoring equipment or monitoring method required in the permit; and

   c. To enter upon the permittee's premises in a reasonable manner and at a reasonable time to inspect and/or investigate, any actual, suspected, or potential source of water pollution, or to ascertain compliance or non compliance with the Colorado Water Quality Control Act or any other applicable state or federal statute or regulation or any order promulgated by the Division. The investigation may include, but is not limited to, the following: sampling of any discharge and/or process waters, the taking of photographs, interviewing of any person having knowledge related to the discharge permit or alleged violation, access to any and all facilities or areas within the permittee's premises that may have any affect on the discharge, permit, or alleged violation. Such entry is also authorized for the purpose of inspecting and copying records required to be kept concerning any effluent source.

   d. The permittee shall provide access to the Division to sample the discharge at a point after the final treatment process but prior to the discharge mixing with state waters upon presentation of proper credentials.

   In the making of such inspections, investigations, and determinations, the Division, insofar as practicable, may designate as its authorized representatives any qualified personnel of the Department of Agriculture. The Division may also request assistance from any other state or local agency or institution.

2. ***Duty to Provide Information***
The permittee shall furnish to the Division, within a reasonable time, any information which the Division may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Division, upon request, copies of records required to be kept by this permit.

3. **Transfer of Ownership or Control**
   a. Except as provided in paragraph b. of this section, a permit may be transferred by a permittee only if the permit has been modified or revoked and reissued as provided in Section 61.8(8) of the Colorado Discharge Permit System Regulations, to identify the new permittee and to incorporate such other requirements as may be necessary under the Federal Act.

   b. A permit may be automatically transferred to a new permittee if:

      i) The current permittee notifies the Division in writing 30 days in advance of the proposed transfer date; and
      ii) The notice includes a written agreement between the existing and new permittee(s) containing a specific date for transfer of permit responsibility, coverage and liability between them; and

iii) The Division does not notify the existing permittee and the proposed new permittee of its intent to modify, or revoke and reissue the permit.

iv) Fee requirements of the Colorado Discharge Permit System Regulations, Section 61.15, have been met.

4. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Clean Water Act and the Colorado Discharge Permit System Regulations 5 CCR 1002-61, Section 61.5(4), all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Division and the Environmental Protection Agency.

The name and address of the permit applicant(s) and permittee(s), permit applications, permits and effluent data shall not be considered confidential. Knowingly making false statements on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Clean Water Act, and Section 25-8-610 C.R.S.

5. Modification, Suspension, Revocation, or Termination of Permits By the Division

The filing of a request by the permittee for a permit modification, revocation and reissuance, termination or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

a. A permit may be modified, suspended, or terminated in whole or in part during its term for reasons determined by the Division including, but not limited to, the following:

i) Violation of any terms or conditions of the permit;

ii) Obtaining a permit by misrepresentation or failing to disclose any fact which is material to the granting or denial of a permit or to the establishment of terms or conditions of the permit; or

iii) Materially false or inaccurate statements or information in the permit application or the permit.

iv) A determination that the permitted activity endangers human health or the classified or existing uses of state waters and can only be regulated to acceptable levels by permit modifications or termination.

b. A permit may be modified in whole or in part for the following causes, provided that such modification complies with the provisions of Section 61.10 of the Colorado Discharge Permit System Regulations:

i) There are material and substantial alterations or additions to the permitted facility or activity which occurred after permit issuance which justify the application of permit conditions that are different or absent in the existing permit.

ii) The Division has received new information which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of different permit conditions at the time of issuance. For permits issued to new sources or new dischargers, this cause includes information derived from effluent testing required under Section 61.4(7)(e) of the Colorado Discharge Permit System Regulations. This provision allows a modification of the permit to include conditions that are less stringent than the existing permit only to the extent allowed under Section 61.10 of the Colorado Discharge Permit System Regulations.

iii) The standards or regulations on which the permit was based have been changed by promulgation of amended standards or regulations or by judicial decision after the permit was issued. Permits may be modified during their terms for this cause only as follows:

(A) The permit condition requested to be modified was based on a promulgated effluent limitation guideline, EPA approved water quality standard, or an effluent limitation set forth in 5 CCR 1002-62, § 62 et seq.; and

(B) EPA has revised, withdrawn, or modified that portion of the regulation or effluent limitation guideline on which the permit condition was based, or has approved a Commission action with respect to the water quality standard or effluent limitation on which the permit condition was based; and

(C) The permittee requests modification after the notice of final action by which the EPA effluent limitation guideline, water quality standard, or effluent limitation is revised, withdrawn, or modified; or

(D) For judicial decisions, a court of competent jurisdiction has remanded and stayed EPA promulgated regulations or effluent limitation guidelines, if the remand and stay concern that portion of the regulations or guidelines on which the permit condition was based and a request is filed by the permittee in accordance with this Regulation, within ninety (90) days of judicial remand.

iv) The Division determines that good cause exists to modify a permit condition because of events over which the permittee has no control and for which there is no reasonable available remedy.

v) The permittee has received a variance.

vi) When required to incorporate applicable toxic effluent limitation or standards adopted pursuant to § 307(a) of the Federal act.

vii) When required by the reopener conditions in the permit.

viii) As necessary under 40 C.F.R. 403.8(e), to include a compliance schedule for the development of a pretreatment program.

ix) When the level of discharge of any pollutant which is not limited in the permit exceeds the level which can be achieved by the technology-based treatment requirements appropriate to the permittee under Section 61.8(2) of the Colorado Discharge Permit System Regulations.

x) To establish a pollutant notification level required in Section 61.8(5) of the Colorado Discharge Permit System Regulations.

xi) To correct technical mistakes, such as errors in calculation, or mistaken interpretations of law made in determining permit conditions, to the extent allowed in Section 61.10 of the Colorado State Discharge Permit System Regulations.

xii) When required by a permit condition to incorporate a land application plan for beneficial reuse of sewage sludge, to revise an existing land application plan, or to add a land application plan.

xiii) For any other cause provided in Section 61.10 of the Colorado Discharge Permit System Regulations.

c. At the request of a permittee, the Division may modify or terminate a permit and issue a new permit if the following conditions are met:

   i) The Regional Administrator has been notified of the proposed modification or termination and does not object in writing within thirty (30) days of receipt of notification,

   ii) The Division finds that the permittee has shown reasonable grounds consistent with the Federal and State statutes and regulations for such modifications or termination;

   iii) Requirements of Section 61.15 of the Colorado Discharge Permit System Regulations have been met, and

   iv) Requirements of public notice have been met.

d. Permit modification (except for minor modifications), termination or revocation and reissuance actions shall be subject to the requirements of Sections 61.5(2), 61.5(3), 61.6, 61.7 and 61.15 of the Colorado Discharge Permit System Regulations. The Division shall act on a permit modification request, other than minor modification requests, within 180 days of receipt thereof. Except for minor modifications, the terms of the existing permit govern and are enforceable until the newly issued permit is formally modified or revoked and reissued following public notice.

e. Upon consent by the permittee, the Division may make minor permit modifications without following the requirements of Sections 61.5(2), 61.5(3), 61.7, and 61.15 of the Colorado Discharge Permit System Regulations. Minor modifications to permits are limited to:

   i) Correcting typographical errors; or

   ii) Increasing the frequency of monitoring or reporting by the permittee; or

   iii) Changing an interim date in a schedule of compliance, provided the new date of compliance is not more than 120 days after the date specific in the existing permit and does not interfere with attainment of the final compliance date requirement; or

   iv) Allowing for a transfer in ownership or operational control of a facility where the Division determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage and liability between the current and new permittees has been submitted to the Division; or

   v) Changing the construction schedule for a discharger which is a new source, but no such change shall affect a discharger's obligation to have all pollution control equipment installed and in operation prior to discharge; or

   vi) Deleting a point source outfall when the discharge from that outfall is terminated and does not result in discharge of pollutants from other outfalls except in accordance with permit limits.

f. When a permit is modified, only the conditions subject to modification are reopened. If a permit is revoked and reissued, the entire permit is reopened and subject to revision and the permit is reissued for a new term.

g. The filing of a request by the permittee for a permit modification, revocation and reissuance or termination does not stay any permit condition.

h. All permit modifications and reissuances are subject to the antibacksliding provisions set forth in 61.10(e) through (g).

6. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject to under Section 311 (Oil and Hazardous Substance Liability) of the Clean Water Act.

7. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority granted by Section 510 of the Clean Water Act. Nothing in this permit shall be construed to prevent or limit application of any emergency power of the division.

8. Permit Violations

Failure to comply with any terms and/or conditions of this permit shall be a violation of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Except as provided in Part I.E and Part II.A or B, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance (40 CFR 122.41(a)(1)).

9. Property Rights

The issuance of this permit does not convey any property or water rights in either real or personal property, or stream flows, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable. If any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances and the application of the remainder of this permit shall not be affected.

11. Renewal Application

If the permittee desires to continue to discharge, a permit renewal application shall be submitted at least one hundred eighty (180) days before this permit expires. If the permittee anticipates there will be no discharge after the expiration date of this permit, the Division should be promptly notified so that it can terminate the permit in accordance with Part II.B.5.

12. Confidentiality

Any information relating to any secret process, method of manufacture or production, or sales or marketing data which has been declared confidential by the permittee, and which may be acquired, ascertained, or discovered, whether in any sampling investigation, emergency investigation, or otherwise, shall not be publicly disclosed by any member, officer, or employee of the Commission or the Division, but shall be kept confidential. Any person seeking to invoke the protection of this Subsection (12) shall bear the burden of proving its applicability. This section shall never be interpreted as preventing full disclosure of effluent data.

13. Fees

The permittee is required to submit payment of an annual fee as set forth in the 2005 amendments to the Water Quality Control Act. Section 25-8-502 (l) (b), and the Colorado Discharge Permit System Regulations 5 CCR l002-61, Section 61.l5 as amended. Failure to submit the required fee when due and payable is a violation of the permit and will result in enforcement action pursuant to Section 25-8-60l et. seq., C.R.S. l973 as amended.

14. Duration of Permit

The duration of a permit shall be for a fixed term and shall not exceed five (5) years. Filing of a timely and complete application shall cause the expired permit to continue in force to the effective date of the new permit. The permit's duration may be extended only through administrative extensions and not through interim modifications.

15. Section 307 Toxics

If a toxic effluent standard or prohibition, including any applicable schedule of compliance specified, is established by regulation pursuant to Section 307 of the Federal Act for a toxic pollutant which is present in the permittee's discharge and such standard or prohibition is more stringent than any limitation upon such pollutant in the discharge permit, the Division shall institute proceedings to modify or revoke and reissue the permit to conform to the toxic effluent standard or prohibition.

16. Effect of Permit Issuance

a. The issuance of a permit does not convey any property rights or any exclusive privilege.

b. The issuance of a permit does not authorize any injury to person or property or any invasion of personal rights, nor does it authorize the infringement of federal, state, or local laws or regulations.

c. Except for any toxic effluent standard or prohibition imposed under Section 307 of the Federal act or any standard for sewage sludge use or disposal under Section 405(d) of the Federal act, compliance with a permit during its term constitutes compliance, for purposes of enforcement, with Sections 301, 302, 306, 318, 403, and 405(a) and (b) of the Federal act. However, a permit may be modified, revoked and reissued, or terminated during its term for cause as set forth in Section 61.8(8) of the Colorado Discharge Permit System Regulations.

d. Compliance with a permit condition which implements a particular standard for sewage sludge use or disposal shall be an affirmative defense in any enforcement action brought for a violation of that standard for sewage sludge use or disposal.

PART III

PRIORITY POLLUTANTS AND HAZARDOUS SUBSTANCES
ORGANIC TOXIC POLLUTANTS IN EACH OF FOUR FRACTIONS
IN ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROSCOPY (GC/MS)
(SEE TABLE II, OF 40 CFR 122 APPENDIX D)

Volatiles	Base/Neutral	Acid Compounds	Pesticides
acrolein	acenaphthene	2-chlorophenol	aldrin
acrylonitrile	acenaphthylene	2,4-dichlorophenol	alpha-BHC
benzene	anthracene	2,4,-dimethylphenol	beta-BHC
bromoform	benzidine	4,6-dinitro-o-cresol	gamma-BHC
carbon tetrachloride	benzo(a)anthracene	2,4-dinitrophenol	delta-BHC
chlorobenzene	benzo(a)pyrene	2-nitrophenol	chlordane
chlorodibromomethane	3,4-benzofluoranthene	4-nitrophenol	4,4'-DDT
chloroethane	benzo(ghi)perylene	p-chloro-m-cresol	4,4'-DDE
2-chloroethylvinyl ether	benzo(k)fluoranthene	pentachlorophenol	4,4'-DDD
chloroform	bis(2-chloroethoxy)methane	phenol	dieldrin
dichlorobromomethane	bis(2-chloroethyl)ether	2,4,6-trichlorophenol	alpha-endosulfan
1,1-dichlorethane	bis(2-chloroisopropyl)ether		beta-endosulfan
1,2-dichlorethane	bis(2-ethylhexyl)phthalate		endosulfan sulfate
1,1-dichlorethylene	4-bromophenyl phenyl ether		endrin
1,2-dichlorpropane	butylbenzyl phthalate		endrin aldehyde
1,3-dichlorpropylene	2-chloronaphthalene		heptachlor
ethylbenzene	4-chlorophenyl phenyl ether		heptachlor epoxide
methyl bromide	chrysene		PCB-1242
methyl chloride	dibenzo(a,h)anthracene		PCB-1254
methylene chloride	1,2-dichlorobenzene		PCB-1221
1,1,2,2-tetrachloroethane	1,3-dichlorobenzene		PCB-1232
tetrachloroethylene	1,4-dichlorobenzene		PCB-1248
toluene	3,3-dichlorobenzidine		PCB-1260
1,2-trans-dichloroethylene	diethyl phthalate		PCB-1016
1,1,1-trichloroethane	dimethyl phthalate		toxaphene
1,1,2-trichloroethane	di-n-butyl phthalate		
trichloroethylene	2,4-dinitrotoluene		
vinyl chloride	2,6-dinitrotoluene		
	di-n-octyl phthalate		
	1,2-diphenylhydrazine (as azobenzene)		
	fluorene		
	fluoranthene		
	hexachlorobenzene		
	hexachlorobutadiene		
	hexachlorcyclopentadiene		
	hexachloroethane		
	indeno(1,2,3-cd)pyrene		
	isophorone		
	naphthalene		
	nitrobenzene		
	N-nitrosodimethylamine		
	N-nitrosodi-n-propylamine		
	N-nitrosodiphenylamine		
	phenanthrene		
	pyrene		
	1,2,4-trichlorobenzene		

OTHER TOXIC POLLUTANTS
(METALS AND CYANIDE) AND TOTAL PHENOLS
(SEE TABLE III, OF 40 CFR 122 APPENDIX D)

Antimony, Total	Total Recoverable Thallium, mg/l
Arsenic, Total	Silver, Total
Beryllium, Total	Thallium, Total
Cadmium, Total	Zinc, Total
Chromium, Total	Cyanide, Total
Copper, Total	Phenols, Total
Lead, Total	
Mercury, Total	
Nickel, Total	
Selenium, Total	

TOXIC POLLUTANTS AND HAZARDOUS SUBSTANCES
REQUIRED TO BE IDENTIFIED BY EXISTING DISCHARGERS
IF EXPECTED TO BE PRESENT
(SEE TABLE II, OF 40 CFR 122 APPENDIX D)

Toxic Pollutants
Asbestos
Hazardous Substances

Acetaldehyde
Allyl alcohol
Allyl chloride
Amyl acetate
Aniline
Benzonitrile
Benzyl chloride
Butyl acetate
Butylamine
Captan
Carbaryl
Carbofuran
Carbon disulfide
Chlorpyrifos
Coumaphos
Cresol
Crotonaldehyde
Cyclohexane
2,4-D(2,4-Dichlorophenoxy acetic acid)
Diazinon
Dicamba
Dichlobenil
Dichlone
2,2-Dichloropropionic acid
Dichlorvos
Diethyl amine
Dimethyl amine
Dinitrobenzene
Diquat
Disulfoton
Diuron
Epichlorohydrin
Ethanolamine
Ethion
Ethylene diamine
Ethylene dibromide
Formaldehyde
Furfural
Guthion
Isoprene
Isopropanolamine
Keithane
Kepone
Malathion
Mercaptodimethur
Methoxychlor
Methyl mercaptan
Methyl methacrylate
Methyl parathion
Mexacarbate
Monoethyl amine
Monomethyl amine
Naled
Napthenic acid
Nitrotoluene
Parathion
Phenolsulfanate
Phosgene
Propargite
Propylene oxide
Pyrethrins
Quinoline
Resorcinol
Strontium
Strychnine
Styrene
TDE (Tetrachlorodiphenylethane)
2,4,5-T (2,4,5-Trichlorophenoxy acetic acid)
2,4,5-TP [2-(2,4,5-Trichlorophenoxy) propanoic acid]
Trichlorofan
Triethylamine
Trimethylamine
Uranium
Vandium
Vinyl Acetate
Xylene
Xylenol
Zirconium

INFLUENT SCREENING REQUIREMENTS

Volatiles
acrolein
acrylonitrile
benzene
bromoform
carbon tetrachloride
chlorobenzene
chlorodibromomethane
chloroethane
2-chloroethylvinyl ether
chloroform
dichlorobromomethane
1,1-dichlorethane
1,2-dichlorethane
1,1-dichlorethylene
1,2-dichlorpropane
1,3-dichlorpropylene
ethylbenzene
methyl bromide
methyl chloride
methylene chloride
1,1,2,2-tetrachloroethane
tetrachloroethylene
toluene
1,2-trans-dichloroethylene
1,1,1-trichloroethane
1,1,2-trichloroethane
trichloroethylene
vinyl chloride
1,4-Dioxane

Semi-VolatileOrganic Compounds
acenaphthene
acenaphthylene
anthracene
benzidine
benzo(a)anthracene
benzo(a)pyrene
3,4-benzofluoranthene
benzo(ghi)perylene
benzo(k)fluoranthene
bis(2-chloroethoxy)methane
bis(2-chloroethyl)ether
bis(2-chloroisopropyl)ether
bis(2-ethylhexyl)phthalate
4-bromophenyl phenyl ether
butylbenzyl phthalate
2-chloronaphthalene
4-chlorophenyl phenyl ether
chrysene
dibenzo(a,h)anthracene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3-dichlorobenzidine
diethyl phthalate
dimethyl phthalate
di-n-butyl phthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
di-n-octyl phthalate
1,2-diphenylhydrazine (as azobenzene)
fluorene
fluoranthene
hexachlorobenzene
hexachlorobutadiene
hexachlorcyclopentadiene
hexachloroethane
indeno(1,2,3-cd)pyrene
isophorone
naphthalene
nitrobenzene
N-nitrosodimethylamine
N-nitrosodi-n-propylamine
N-nitrosodiphenylamine
phenanthrene
pyrene
1,2,4-trichlorobenzene
2-chlorophenol
2,4-dichlorophenol
2,4,-dimethylphenol
4,6-dinitro-o-cresol
2,4-dinitrophenol
2-nitrophenol
4-nitrophenol
pentachorophenol
phenol
2,4,6-trichlorophenol
1,4-Dioxane

Metals
Aluminum-Trec*
Antimony-Trec
Arsenic-Trec and PD*
Barium-Trec
Beryllium-Trec
Cadmium-Trec and PD
Chromium III-Trec and PD
Chromium VI-Trec and Diss*
Copper-Trec and PD
Iron-Trec and Diss
Lead-Trec and PD
Manganese-Trec and Diss
Molybdenum-Trec
Nickel-Trec and PD
Selenium-Trec and PD
Silver-Trec and PD
Thallium-Trec and PD
Uranium-Trec and PD
Zinc-Trec and PD

*Trec=Total Recoverable
*PD=Potentially Dissolved
*Diss=Dissolved

COLORADO
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

FOR DIVIISION USE ONLY

Effective date_____

COLORADO WATER QUALITY CONTROL DIVISION TERMINATION APPLICATION

Print or type all information. Mail original form with ink signature to the following address. Emailed and Faxed forms will not be accepted. All items must be filled out completely and correctly. If the form is not complete, you will be asked to resubmit it.

Colorado Dept of Public Health and Environment
Water Quality Control Division WQCD-P-B2
4300 Cherry Creek Drive South
Denver CO 80246-1530

PART A. IDENTIFICATION OF PERMIT OR AUTHORIZATION - Please limit submission to one permit, certification, or authorization per form. All permit termination dates are effective on the date approved by the division. Processing times vary by type of discharge. Some discharge types require onsite inspections to verify information in this application.

PERMIT, CERTIFICATION, OR AUTHORIZATION NUMBER (DOES NOT END IN 0000)_____

PART B. PERMITTEE INFORMATION

Company Name_____

Legal Contact First Name_____Last Name_____

Title_____

Mailing Address_____

City _____State_____Zip Code_____

Phone_____Email address_____

PART C. FACILITY OR PROJECT INFORMATION

Facility/Project name_____

Location/Address _____

City _____County_____

Local contact name_____Title_____

Phone_____ Email address_____

PART D. TERMINATION INFORMATION QUESTIONS Provide information for Part D that applies to your facility and termination request. Not all questions need to be answered- only the part that applies to your facility.

Part D1 covers facilities no longer in operation.
Part D2 covers mining facilities no longer in operation
Part D3 covers facilities in operation but no longer discharging or needing permit coverage.
Part D4 covers Stormwater Construction facilities where construction is complete and the site is stabilized.
Please answer questions as completely as possible to assist in timely approval of this termination request.

☐ **D1. FACILITY IS NO LONGER IN OPERATION AT THIS LOCATION**

All activities and discharges at the identified site have ceased; all potential pollutant sources have been removed; all industrial wastes have been disposed of properly; all DMR's, Annual Reports, and other reports have been submitted; and all elements of a Stormwater Management Plan have been completed (if this applies).

**FOR LAGOONS: please reference "information regarding Domestic Treatment Works Closure at Wastewater Treatment Facilities"

D2. MINING FACILITY IS NO LONGER IN OPERATION AT THIS LOCATION.
Sand and Gravel, Coal or Hard Rock Mining

☐ A. Mining operation is no longer discharging process/treated water. Bond has not been released by DRMS. A stormwater only permit is requested at this time. Attach application for Stormwater Only permit.

B. Reclamation of mining site is completed. Bond has been released by DRMS.
☐ YES Attach a copy of the Bond release letter. ☐ NO Explain below:

C. Reclamation of mining site is complete. Is there any continued mine drainage? Eg. Adits or unreclaimed waste piles? ☐ YES , Please explain, attach additional pages as necessary.

D3. FACILITY IS STILL IN OPERATION BUT IS NO LONGER DISCHARGING OR NO LONGER NEEDS A PERMIT

☐ A. Facility continues to operate, however the activity producing the discharge has ceased (including changes in SIC Code resulting in change in duty to apply).

☐ B. Termination is based on alternate disposal of discharges (discharge is being disposed of in another way)
a. Solid waste disposal unit (e.g. evaporative ponds)
b. No Exposure Exclusion (for industrial stormwater facilities only.) NOX Number_____
c. Combined with another authorized discharge. Permit Number _____
d. Permit is not required (includes coverage by low risk policy, etc.) – please explain, attach additional pages if necessary

☐ C. PERMITTEE IS NO LONGER THE OWNER/OPERATOR OF THE SITE and all efforts have been made to transfer the permit to appropriate parties. Please attach copies of registered mail receipts, letters, etc.

D4. STORMWATER CONSTRUCTION FACILITIES WHERE CONSTRUCTION IS COMPLETE (Select A, B, or C)

☐ A. SITE IS FINALLY STABILIZED OR CONSTRUCTION WAS NOT STARTED

a. The permitted activities meet the requirements for FINAL stabilization in accordance with the permit, the Stormwater Management Plan, and as described in item b. (explanation can be construction activities were not started).
b. Describe the methods used to meet final stabilization. (Required)

*Final Stabilization defined on page 3

D4. STORMWATER CONSTRUCTION FACILITIES WHERE CONSTRUCTION IS COMPLETE (Continued)

☐ B. ALTERNATIVE PERMIT COVERAGE OR FULL REASSIGNMENT

a. All ongoing construction activities including all disturbed areas, covered under the permit certification listed in Part B have coverage under a separate CDPS Stomwater Construction permit. The Division's Reassignment form was used by the permittee to reassign all areas and activities.

b. Permit certification number covering the ongoing activities (Required)_____

☐ C. PERMITTEE IS NO LONGER THE OWNER OR OPERATOR OF THE FACILITY

All efforts have been made to transfer the permit to appropriate parties. Please attach copies of registered mail receipt, letters, etc.

***Final stabilization is reached when:** all ground surface disturbing activities at the site have been completed including removal of all temporary erosion and sediment control measure, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of predisturbance levels, or equivalent permanent, physical erosion reduction methods have been employed.

PART E. CERTIFICATION SIGNATURE REQUIRED FOR ALL TERMINATION REQUESTS

I certify under penalty of law that this document and all attachments were prepared under my direction and/or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those individuals immediately responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. " (See 18 USC 1001 and 33 USC 1319)

I certify that I am the legal representative of the above named company (PART B page 1).

☐ **Applies to Stormwater Construction terminations:**
I understand that by submitting this notice of termination, I am no longer authorized to discharge stormwater associated with construction activity by the general permit. I understand that discharging pollutants in stormwater associated with construction activities to the waters of the State of Colorado, where such discharges are not authorized by a CDPS permit, is unlawful under the Colorado Water Quality Control Act and the Clean Water Act.

Signature of Legally Responsible Party Date Signed

Name (printed) Title

Signatory requirements: This termination request shall be signed, dated, and certified for accuracy by the permittee in accord with the following criteria:

1. In the case of a corporation, by a principal executive officer of at least the level of vice-president, or his or her duly authorized representative, if such representative is responsible for the overall operation of the operation from which the discharge described herein originates;
2. In the case of a partnership, by a general partner;
3. In the case of a sole proprietorship, by the proprietor;
4. In the case of a municipal, state, or other public operation, by either a principal executive officer, ranking elected official, or other duly authorized employee.

Appendix B

DENVER
THE MILE HIGH CITY

CONNECT WITH US | 311 | POCKETGOV.COM | DENVERGOV.ORG | DENVER 8 TV

Pre-Dig Checklist for Contractors

INFORMATION	
Project	
Project Name	
Telephone number:	
Superintendent or Project Manager	

	CHECKLIST	YES	NO	N/A
☐	City Project Inspector and Project Manager were notified a minimum of 10 days in advance of any soil disturbing activities.			
☐	Contractor's has posted the DIG SAFE Poster in trailer.			
☐	Does the project have a Contractor's field representative has read the project specific Health and Safety Plan?			
☐	If yes, Contractor has hired a Health and Safety Officer and he/she has reviewed the project specific Health and Safety Plan .			
☐	If no, Contractor's field representative has read the City and County of Denver's Safety and Health Manual.			
☐	If there is reasonable suspicion that ACS (Asbestos-Contaminated soil) or ACM (Asbestos containing materials) may be encountered during soil disturbing activities, the Contractor has hired a Certified Asbestos Building Inspector (CABI) who will be present for all soil disturbing activities.			
☐	The Contractor has verified that all field personnel has completed Asbestos Awareness Training.			
☐	The Contractor's field representative Tailgate training completed with all personnel associated with trenching or digging.			

Appendix C

APPENDIX

FEDERAL BOULEVARD RECONSTRUCTION
5TH AVENUE TO HOWARD PLACE

SURVEY REQUIREMENTS

RANGE POINTS AND MONUMENTS

The Contractor shall survey range point sand monuments in accordance with the requirements of the City of Denver survey standards and drawing found on the follow this pages.

Public Works
Right-of-Way Services/Survey

201 W. Colfax Ave. Dept. 507
Denver, CO 80202

Range Point Monuments

If in asphalt - #6 rebar, 30" long, with a durable cap marked "Range Point" and bearing the PLS number of the Surveyor in responsible charge. Monument should be set in a range box per current City standards.

If in concrete – set monument and range box as described above. In some limited circumstances, a 2 1/2 inch metal rock cap drilled and recessed so that the top of the cap is flush or just below the concrete surface so as not to be destroyed by snow plows, marked as above may be allowed. Contact the Area Surveyor for direction.

If as part of the development or other known construction activities it is known that major work will be performed on the streets where the range points are to be set, then temporary range points (standard pin and cap set flush with the pavement) may be set and are to be replaced by the developer prior to a TCO or CO being approved or acceptance of the roadway for warranty purposes.

All range points, temporary or permanent, will have tie points set and a tie book record completed and submitted to the City Surveyor for the survey records.

Monument Ties

Objective:

To establish identifiable and durable ties so that the position of the range point may be recreated. Additionally, these ties are to be documented allowing their usage by the general public.

Specifications:

1. A minimum of three (3) ties are to be set for each of the range points rehabilitated. It is preferred that if conditions allow, four (4) ties should be set.
    1.1. A cut "X" must be used as a tie. Items such as PK or mag nails are not allowed.
2. Existing monuments (for example, chiseled crosses) should be used as ties if they meet the conditions set forth for a new tie.
3. A new tie must be identifiable as an "X" and not a "+".
    3.1. This procedure will avoid confusing the tie with a property marker.
4. A new tie must not be set on a direct offset to the range point.
    4.1. This procedure will avoid confusing the tie as being a direct offset.
5. The geometry of the ties in relation to the range point should be taken into consideration.
    5.1. For example, in a typical intersection, ties placed on the sidewalk at each of the intersection's four quadrants would be an ideal figure.
    5.2. Linear, or close to linear, configurations should be avoided.
6. It is recommended the new ties be cut with a diamond tipped blade.

6.1. A 3.5” diameter circular blade on a battery powered saw is recommended.

7. Unless traffic safety is a concern, all tie distances are to be determined using a survey chain.
   7.1. At the discretion of the field crew, a total station may be used in areas where traffic is a concern.
8. All monument tie distances shall be measured and recorded to the nearest one-hundredth of a foot.
9. All ties should be identified as being found or set.
10. Each monument record should show ties for only one range point.
11. The “X” should be approximately 2” x 2” long and a minimum of 1/16” deep.

Ramp locations should be avoided for ties as they are frequently replaced.

Box/Riser Assembly Rehabilitation

Objective:

To install a box/riser assembly that protects and allows access to the range point. The assembly also allows for accommodation of the city’s annual paving programs.

Specifications:

1. A new box and 3” riser are required for each monument.
2. The top of the box/riser assembly shall be set at a height that is no less than ¼” and no greater than ½” below the existing roadway grade.
3. Deep monuments may require an 8” diameter PVC pipe as a spacer. This PVC spacer is placed below the assembly.
4. If necessary, lower the monument so that it is a minimum of 3 ½” below the existing roadway grade.
   4.1. The monument should be straddled prior to lowering the monument.
5. Depending upon the stability of the monument, it may be required to straddle the monument prior to excavation of the area.
6. The excavation area should be a 2’ x 2’ hole.
7. The contractor is responsible for determining if utility locates are needed prior to excavation.
8. The contractor is responsible to obtain a street occupancy permit for excavations in residential streets.
9. The contractor shall be accompanied by City and County of Denver personnel when excavating in collector or arterial streets. If not accompanied by City personnel than the contractor will need to obtain a separate street occupancy permit and provide traffic control.

Monument Tie Record

Objective:

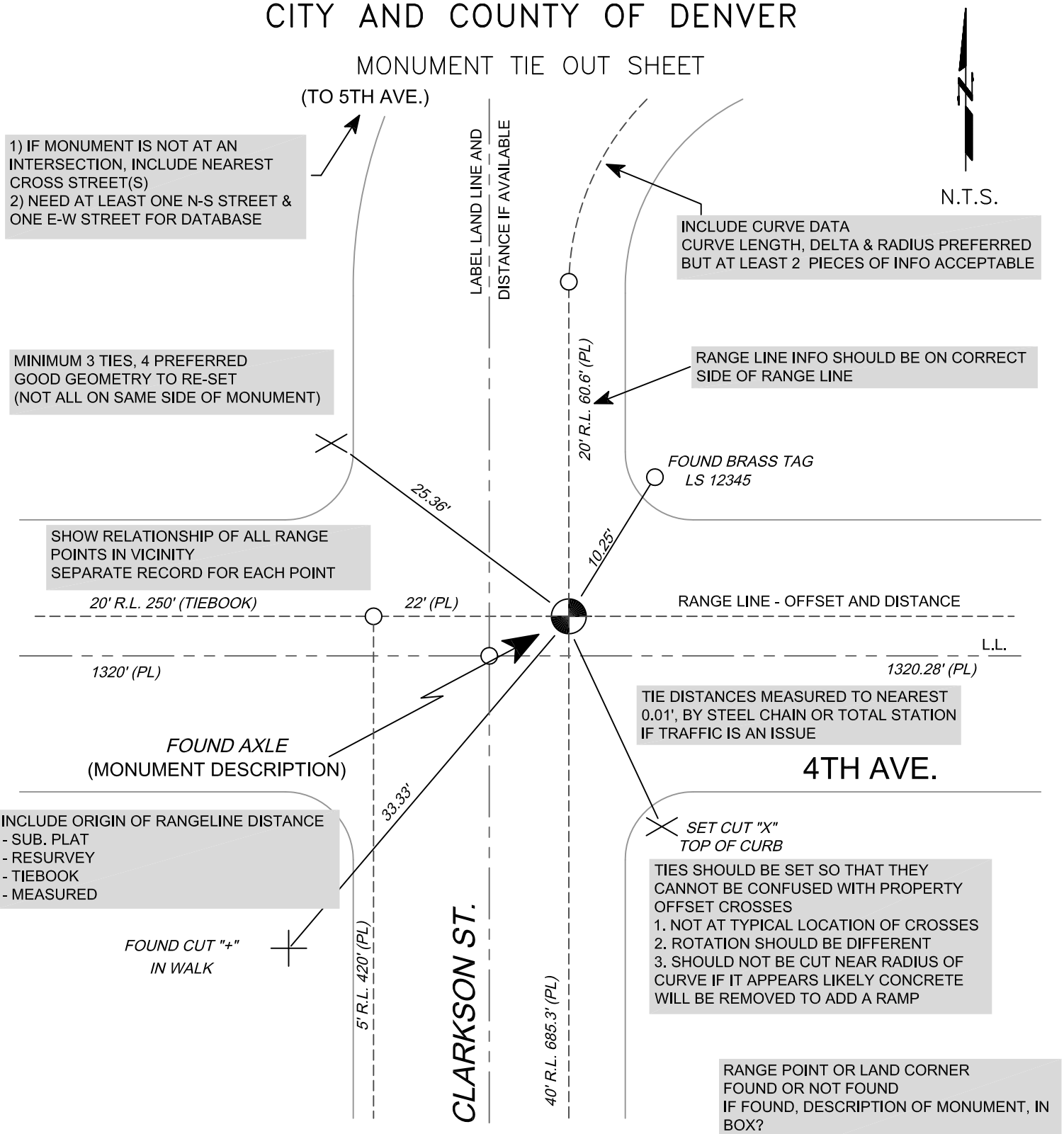
The monument record is used to document actions taken by the field crews during the rehabilitation process. The record will also show the locations and distances of the range point ties. The records are made available to the general public.

Specifications:

1. All information pertaining to the date and crew should be completed.
2. Street names should be identified, with at least 1 east-west avenue and 1 north-south street included. If the range point is not located at an intersection, the nearest cross streets should be identified.
3. Identify range lines on the tie record (i.e. 20' RL, 30' RL, etc.), with the offset on the correct side of the range line.
4. Label all available platted range line dimensions that relate to the point. After the distance, identify how the distance was obtained (i.e. subdivision plat (or P), resurvey, tiebook, etc.)
5. If there are multiple range points at an intersection, the record should depict them all relative to each other.
6. When appropriate, curve data should be included, with the inclusion of curve length, delta and radius being optimum, and 2 of the previous pieces of data being acceptable.
7. Land lines depicted should be labeled.
8. If the range point is found, then the record should include descriptive notations of the found monument.
9. If the range point is not found, describe the methods used to search for the point and note if any digging took place. Describe the extent of the search location, including how far down in depth the search was.
10. A diligent search shall be made for all called for stone monuments.
11. City and County of Denver tie out sheet will require a cover letter by PLS as reviewed and approved. Initials by PLS on each record.
12. A box/riser assembly shall be placed on Land Corners within project limits per state statutes.

CITY AND COUNTY OF DENVER

MONUMENT TIE OUT SHEET



INFORMATION TO BE SHOWN

1. Range Points (monument desc.) & Range Lines
2. Section Corners & Land Lines
3. Range Point Ties (found or set)
4. Street Names
5. Platted rangeline dimensions to identify Range Points not at an intersection
6. If monument is not found, describe the extent of the search

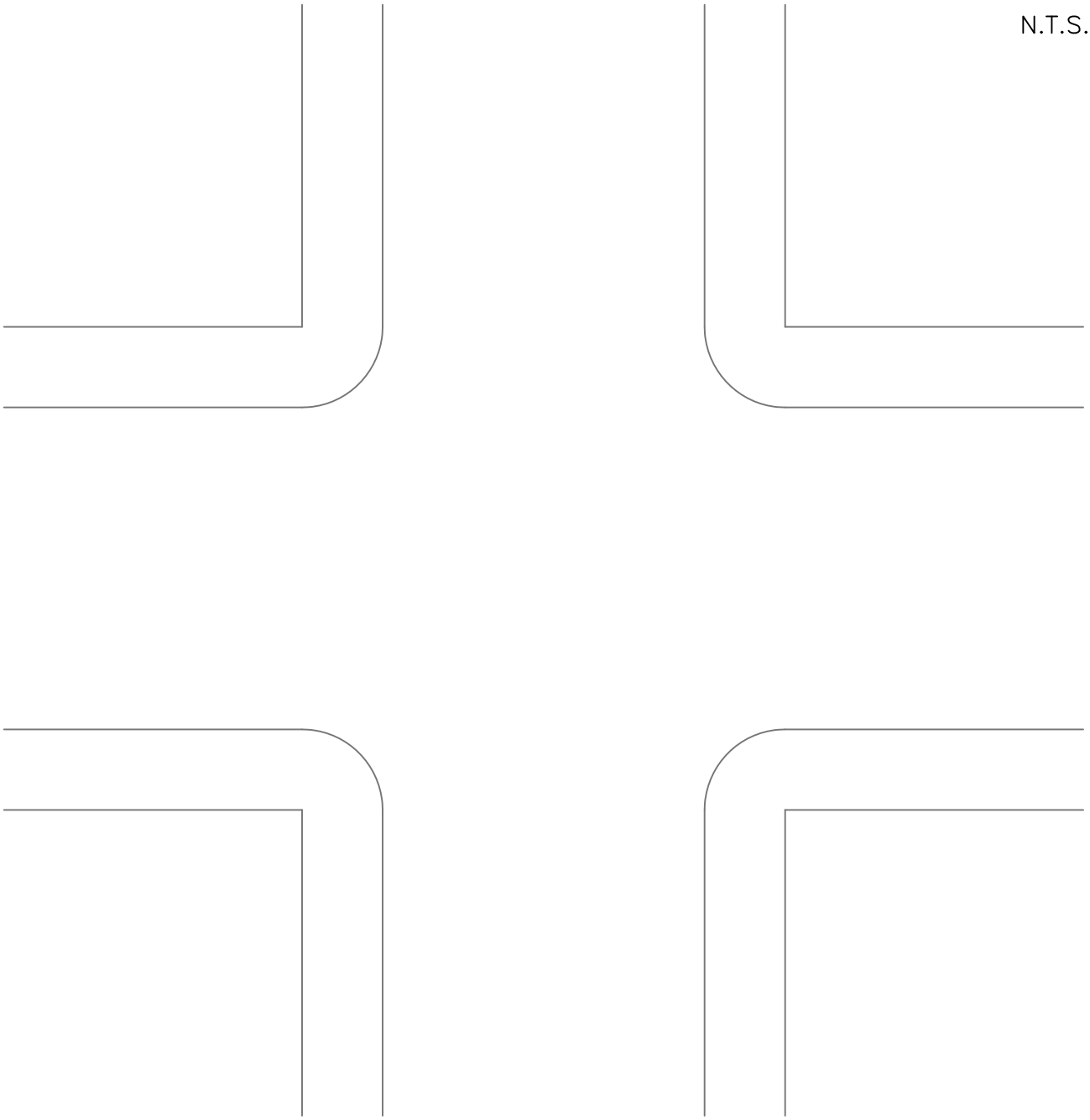
_____
DATE

_____
FIRM/CREW

CITY AND COUNTY OF DENVER

MONUMENT TIE OUT SHEET

N.T.S.



INFORMATION TO BE SHOWN

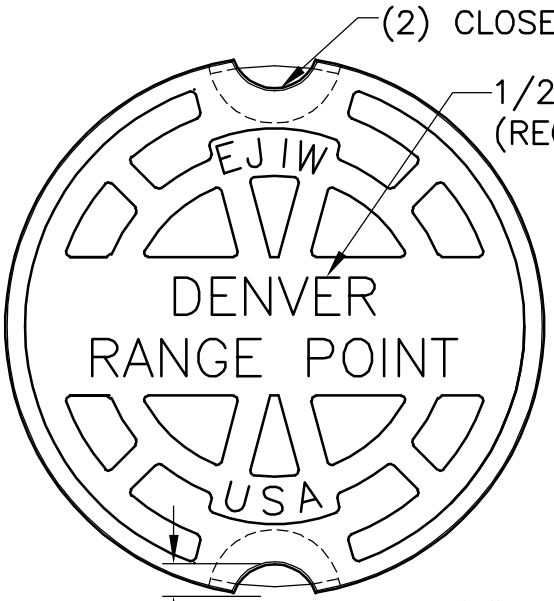
1. Range Points (monument desc.) & Range Lines
2. Section Corners & Land Lines
3. Range Point Ties (found or set)
4. Street Names
5. Platted rangeline dimensions to identify Range Points not at an intersection
6. If monument is not found, describe the extent of the search

_____

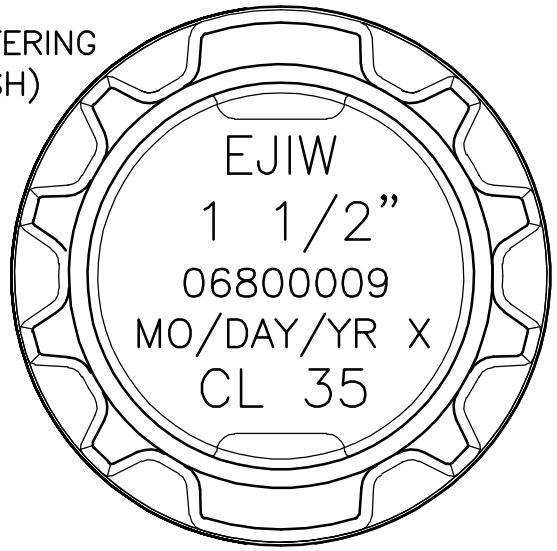
DATE

_____

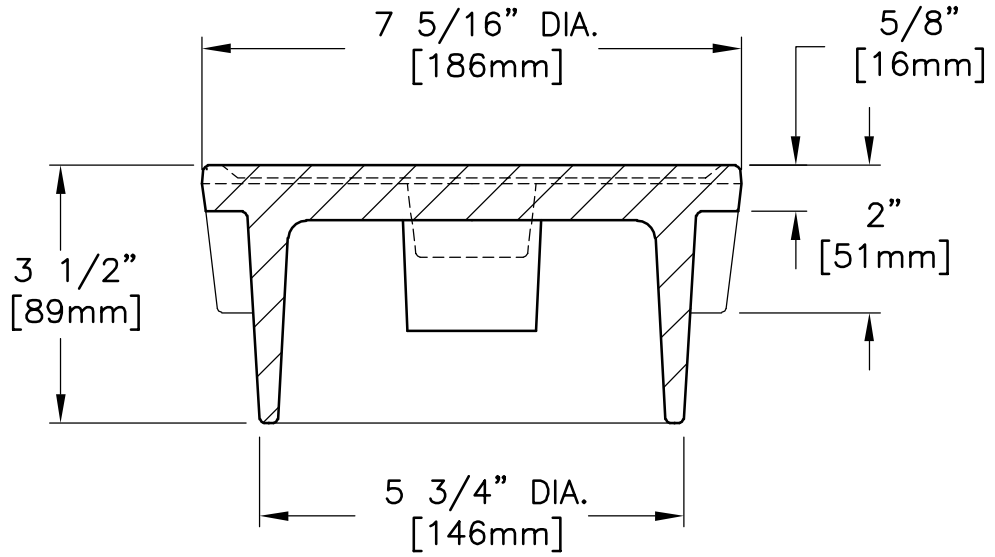
FIRM/CREW



PLAN VIEW



BOTTOM VIEW



SECTION VIEW

EAST JORDAN
IRON WORKS, INC.
P.O. BOX 439
EAST JORDAN, MI. 49727
1-800-874-4100
FAX 231-536-4458

DRAWN	DATE
TCL	02/25/05
APPROVED	DATE

5 1/4" DROP LID
1 1/2" SKIRT
(DENVER RANGE POINT)

PRODUCT NO.

06800009

CATALOG NO.

6800

REF. PRODUCT DRAWING

06800001

EST. WT.

COVER: 14 LBS 6kg

OPEN AREA

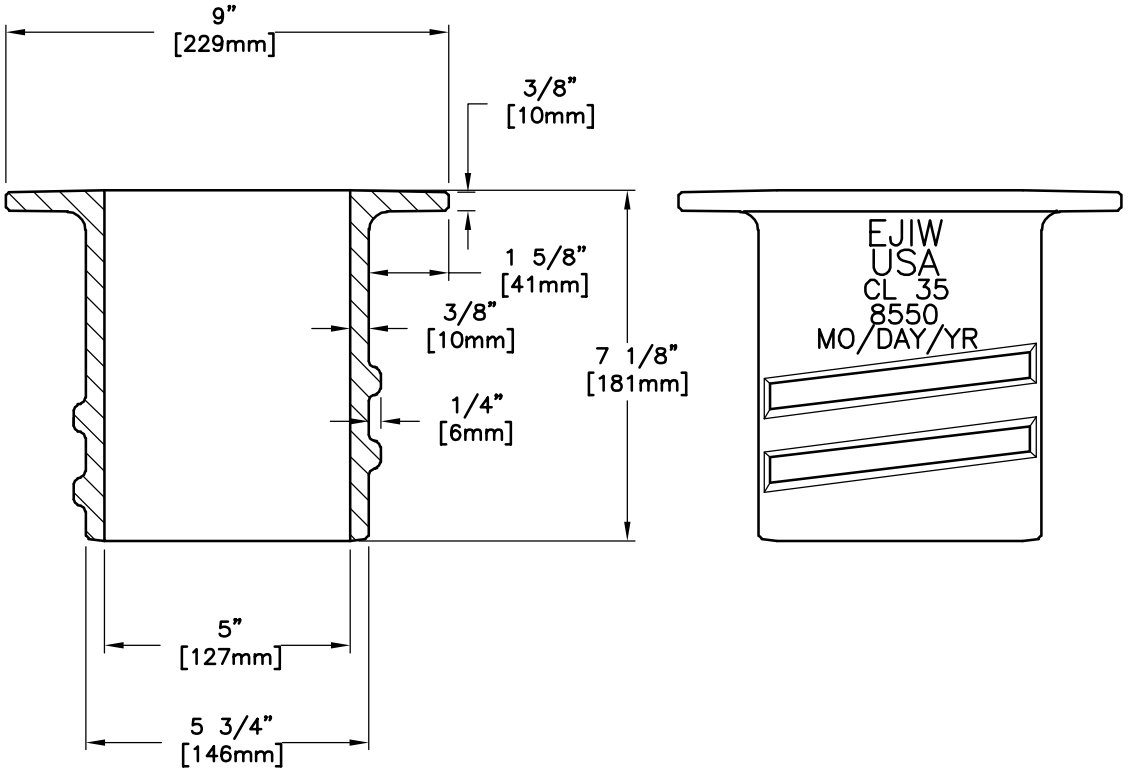
N/A

MAT'L SPEC.

COVER – GRAY IRON
ASTM A48 CL35B

LOAD RATING

HEAVY DUTY



EAST JORDAN
IRON WORKS, INC.
P.O. BOX 439
EAST JORDAN, MI. 49727
1-800-874-4100
FAX 231-536-4458

DRAWN	DATE
TCL	05/04/01
APPROVED	DATE

8550 BOTTOM SCREW BASE

PRODUCT NO.

85506007

CATALOG NO.

8550

REF. PRODUCT DRAWING

85506007

EST. WT.

BASE: 17 LBS 8 kg

OPEN AREA

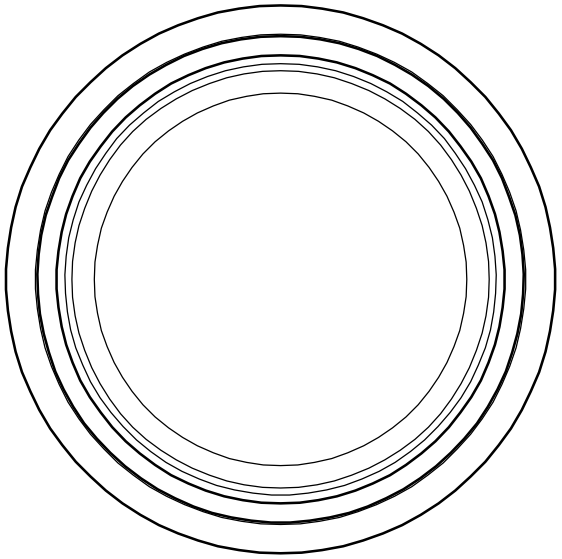
N/A

MAT'L SPEC.

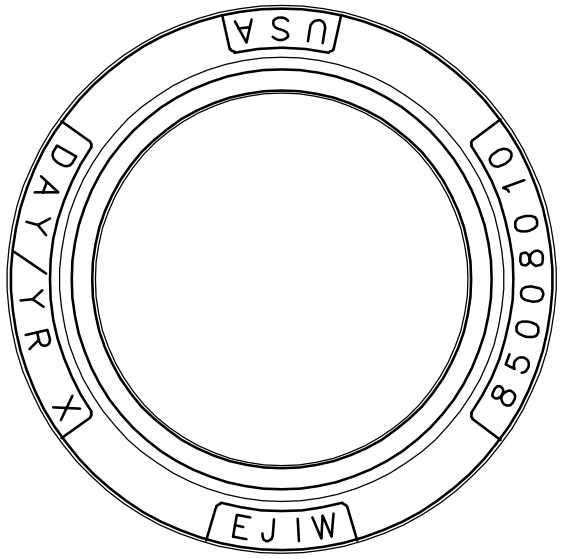
BASE – GRAY IRON
ASTM A48 CL35

LOAD RATING

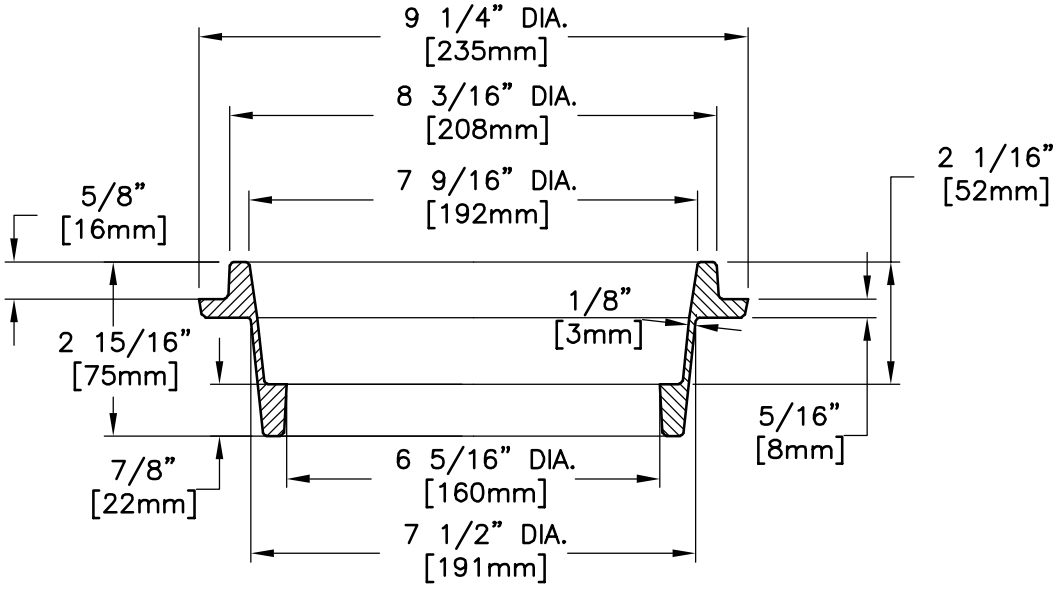
NON-TRAFFIC



TOP VIEW



BOTTOM VIEW



SECTION VIEW

EAST JORDAN
IRON WORKS, INC.
P.O. BOX 439
EAST JORDAN, MI. 49727
1-800-874-4100
FAX 231-536-4458

DRAWN	DATE
TCL	04/01/04
APPROVED	DATE

1" VALVE BOX RISER

PRODUCT NO.

85008010

CATALOG NO.

8500

REF. PRODUCT DRAWING

85008010

EST. WT.

RISER: 6 LBS 3kg

OPEN AREA

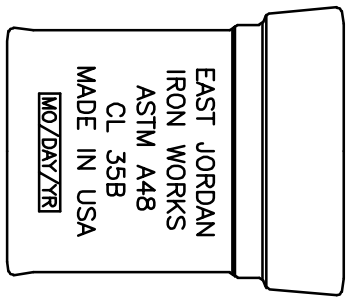
N/A

MAT'L SPEC.

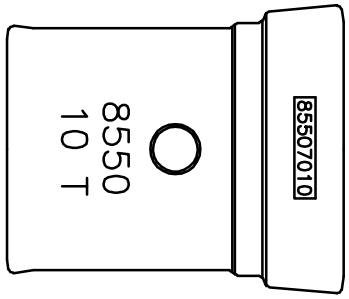
RISER – GRAY IRON
ASTM A48 CL35B

LOAD RATING

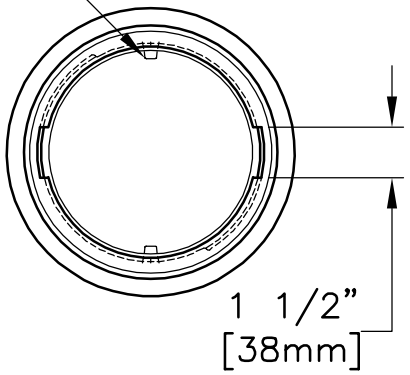
HEAVY DUTY



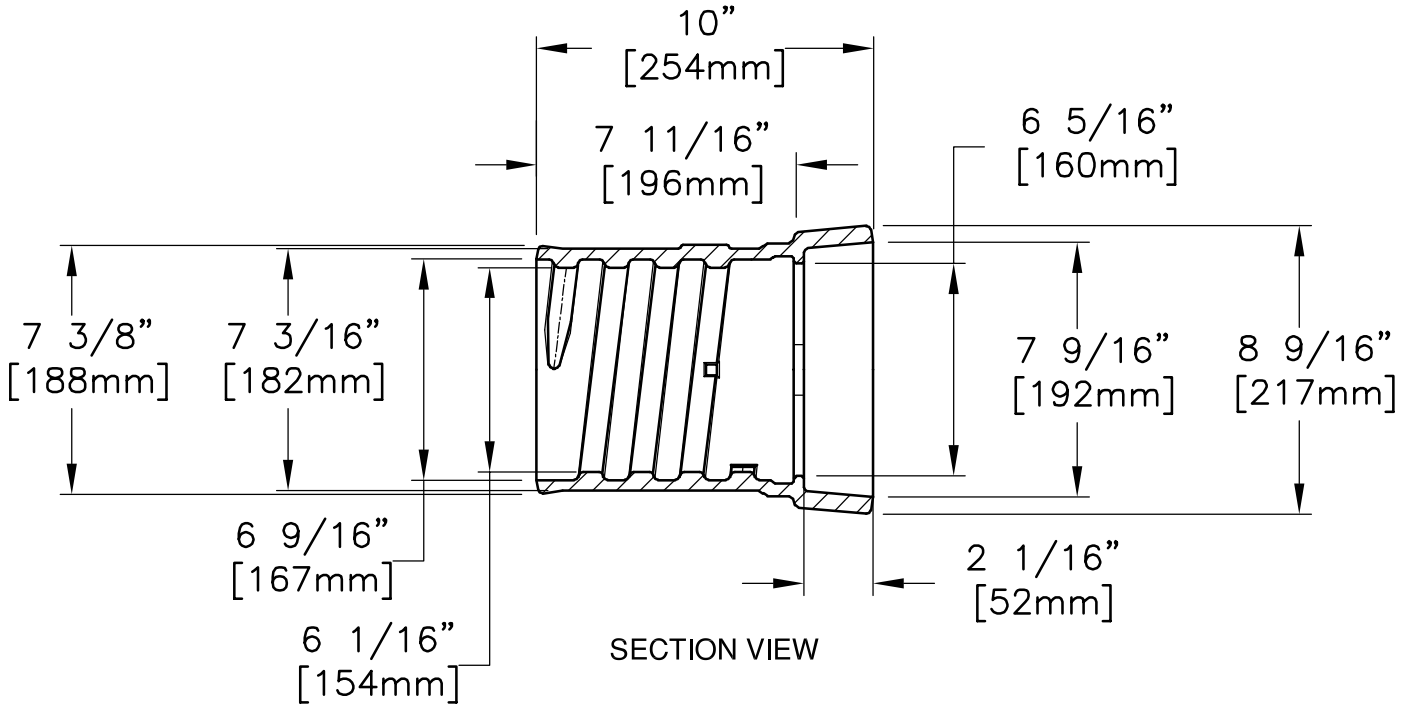
VIEW OF BACK SIDE LETTERING



PLAN VIEW



TOP VIEW



SECTION VIEW

EAST JORDAN
IRON WORKS, INC.
P.O. BOX 439
EAST JORDAN, MI. 49727
1-800-874-4100
FAX 231-536-4458

DRAWN	DATE
TCL	09/29/05
APPROVED	DATE

8550 10T VALVE BOX TOP

PRODUCT NO.

85507010

CATALOG NO.

8550

REF. PRODUCT DRAWING

85507010

EST. WT.

VALVE T: 25 LBS 11kg

OPEN AREA

N/A

MAT'L SPEC.
VALVET – GRAY IRON
ASTM A48 CL35

LOAD RATING

HEAVY DUTY

Appendix D

Yeh and Associates, Inc.

Revised Final Pavement Design And Geotechnical Engineering Report

Federal Blvd. Reconstruction
6th Avenue to Howard Place
Denver, Colorado

Project Number: CC 0881-025
(18365)

Yeh Project No. 211-117
September 16, 2016

Prepared for:

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Revised Final Pavement Design And Geotechnical Engineering Report

Federal Blvd. Reconstruction
6th Avenue to Howard Place
Denver, Colorado

Project Number: CC 0881-025
(18365)

Yeh Project No. 211-117
September 16, 2016

YEH AND ASSOCIATES, INC.

Prepared by:

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1.0 Project Information

1.1 Purpose and Scope of Study

This report documents the results of the geotechnical investigation and pavement design recommendations for reconstruction of Federal Boulevard between 6th Avenue and West Howard Place in Denver. The report was originally issued on February 27, 2012 and is being revised to address the change because of increased design traffic loading. The pavement design is now based on traffic loading with the build year anticipated to be 2017.

The scope of work for this study includes exploring the subsurface conditions by advancing exploratory borings at approximately 500 foot intervals along northbound Federal Boulevard and 500 foot intervals along southbound Federal Boulevard. The borings are staggered so that there is approximately 250 feet between the boring on the northbound side and the one on the southbound side. Soil samples were retrieved from the borings, inspected, and subjected to appropriate laboratory testing. Groundwater levels, if encountered, were checked during drilling and documented. The results of the field exploration and laboratory testing were analyzed to obtain parameters for pavement design recommendations. Recommendations will be provided for the minimum required Portland cement concrete (PCC) pavement thickness and for the minimum required pavement thickness of hot mix asphalt (HMA)

2.0 Proposed Construction

The proposed work will take place on Federal Boulevard between 6th Avenue and West Howard Place. The work will include the widening and reconstruction of Federal Boulevard. The wider typical section of Federal will be accomplished by holding the west side at the existing location and widening to the east. Figure 1 presents a photograph of the project location showing Federal Boulevard and the surrounding area.

3.0 Geologic Conditions

The geology of the site was studied by reviewing relevant geologic maps. The general geology is based upon our review and our experience in the general area.

In general, the site is located east of the Front Range piedmont of the Southern Rocky Mountain Region. The area is generally overlain by windblown alluvial sand

containing various amounts of silt and clay. The overburden is lower Holocene to upper Pleistocene in age. The bedrock in the project area is generally considered to be the Dawson and Denver Formation of lower Paleocene to upper Cretaceous age, arkosic

Figure 1 - Project Location

sandstone, claystone, siltstone, and conglomerates. The Dawson Formation is intertongued with the Denver Formation of the same age and similar makeup.

4.0 Subsurface Exploration

Seventeen borings were taken along Federal Boulevard between 7th Avenue and West Howard Place on August 30th and 31st with an approximate longitudinal spacing of 250 feet. Eight borings were completed on the northbound side of Federal (P-01 to P-08), seven on the southbound side (P-11 to P-17). Boring P-09 is located approximately 95 feet east of Federal on 9th Avenue and Boring P-10 is located approximately 65 feet east of Federal on 11th Avenue. Both borings are located outside of the project area, but still provide good subsurface information on these two streets. The exploratory borings were advanced to a depth from 5 to 10 feet. Approximate locations of the exploratory borings are presented on Boring Location Map, Figure 2a-2c.

The exploratory borings were drilled by using a truck-mounted CME-45 drill rig. All test holes were advanced using 6-inch outside diameter, solid- stem augers to a depth varying from 5 to 10 feet. Bulk soil samples were taken from below the pavement section to a depth of 5 feet. California tube samples were taken at depths of three or five feet along with the penetration tests. Groundwater was not encountered in the borings during our investigation.

To perform the penetration test (PT), a 2-inch inside diameter California spoon sampler was seated at the bottom of the bore hole, then driven up to 12 inches with blows of an automatic standard hammer weighing 140 pounds and falling a distance of 30 inches. The number of blows (blow count) required to drive the sampler 12 inches or a fraction thereof, constitutes the PT. The PT is similar to the standard penetration test described in ASTM Designation D1586. The PT, when properly evaluated, is an index to the consistency or relative density of the material tested. For the soils on this project, the blow counts varied from 5 to 20 indicating loose to medium dense subgrade soils. The complete results are shown on the engineering geology sheets and boring logs in Appendix A.

Figure 2a - Boring Location Map

Figure 2b - Boring Location Map

Figure 2c - Boring Location Map

Existing pavement and fill soils were encountered during drilling. Asphalt and either natural or fill material, was encountered in all of the borings.

Based on the boring information, the existing Federal Boulevard pavement thickness varied from 6.5 to 17 inches of HMA on predominantly clay or sandy clay fill material. As shown in Table 1, there are isolated locations containing aggregate base course. The average HMA thickness on Federal Boulevard is 13.8 Inches. Table 1 shows the pavement thickness for each boring.

Table 1 - Existing Pavement Thickness

Boring Number	HMA Thickness (inches)	ABC Thickness (inches)	Subbase Soil Classification
P-01	13.5		A-7-6(23)
P-02	15		A-7-6(6)
P-03	14		A-1-b(0)
P-04	13		A-6(3)
P-05	11.5		A-6(3)
P-06	6.5	7	A-2-4(0)
P-07	15		A-2-4(0)
P-08	16.5		A-6(5)
P-09 (9th Ave.)	4.5	4	A-7-6(12)
P-10 (11th Ave.)	7.25		A-4(0)
P-11	16		A-7-6(18)
P-12	14.5		A-2-4(0)
P-13	14		-
P-14	17		A-6(3)
P-15	14.5	15	A-7-6(20)
P-16	12.25		A-7-6(18)
P-17	13.5	5	A-7-6(19)
Average	13.8		

5.0 Laboratory Testing

Samples retrieved during the field exploration were returned to the laboratory for observation by the project geotechnical engineer and were classified in accordance with AASHTO and the Unified Soil Classification System. A program of laboratory testing was developed to determine engineering properties of the subsurface materials. Following the completion of the laboratory testing, the field descriptions of the samples

were confirmed or modified as necessary and placed on the boring logs which are presented in Appendix A.

Laboratory test results are presented in Appendix B. These results were used for the geotechnical engineering analyses and the determination of minimum acceptable pavement thickness design calculations and recommendations. Laboratory tests were performed in general accordance with the applicable ASTM and AASHTO test methods and MGPEC and CDOT Standards. The results are summarized below.

5.1 Soil Classification

Soil classification tests consisted of Atterberg limits determination and sieve analysis tests. Atterberg Limit tests were performed in general accordance with AASHTO M145. The water content and natural moisture and density was determined following AASHTO T 265 and T 204. Sieve analyses on samples from the sites were performed in accordance with ASTM D1140. The test results were then used in classifying the soil according to the AASHTO and USCS Classification Standards.

The AASHTO and USCS soil classification for California tube samples are presented in Appendix B.

The soil classifications of the individual soil samples ranged from A-1-b to A-7-6. Of the 25 individual classification tests, 12 samples were classified as A-7-6 soils and 5 were classified as A-6 soils, clay or sandy clay. These clayey soils are considered the weakest soils for soil support, so the subgrade strength for design will be based on the R-values, unconfined compressive strength measurements and k-values of these soils. The remainder of the soil samples had the following classification; one - A-1-b soil, six - A-2 soils, and one - A-4 soil.

Three composite bulk samples were created by combining the bulk samples from the borings. Mix-1 combined samples from borings P-4, P-5, P-8, P-10 and P-14. The AASHTO soil classification of the Mix-1 bulk sample was A-6 (2). This combined sample was used to measure the R-value in accordance with AASHTO T190 and the R-value measured was 16. Mix-2 combined samples from borings P-1, P-11, P-16, and P-17. The AASHTO classification of the Mix-2 bulk sample was A-7-6. Again this combined sample was used to measure the R-value in accordance with AASHTO T190 and the R-value measured was 6.

Mix-3 combined samples from borings P-1, P-9, P-11, P-15 and P-17. These bulk soil samples all were classified as A-7-6 soils and were combined and tested for unconfined compressive strength to be used as direct input to the MGPEC Pavement Design program. The unconfined compressive strength of the combined sample was 2,721 pounds per square foot (psf.).

The R-value of 6 was also used to calculate a resilient modulus (M_R) of 3,126 psi which is used as input to the DARWin pavement design program and the unconfined compression strength of 2,721 psf was used as an input into MGPEC design program. DARWin is an AASHTO program and follows the 1993 AASHTO Pavement Design Guide. It is the program CDOT uses to design HMA pavement thicknesses.

The A-7-6 soil classifications was used in conjunction with Figures 2.6 and 2.7 of the CDOT pavement design manual to determine a k-value of 50 psi/inch for input to the concrete pavement design program in 1998 FHWA Supplement to the 1993 AASHTO Pavement Design Guide. Complete laboratory soil test results are presented in Appendix B.

5.2 Soil Corrosion and Sulfate Attack

Water-soluble sulfate, pH, chloride and resistivity tests were performed to evaluate corrosion potential and the potential sulfate attack on concrete. As presented in Appendix B, Summary of Laboratory Test Results, the general characteristics of the soils at the sites indicate pH range of 8.0 to 8.5 considered slightly basic, and soluble sulfate in the soils ranged from a concentration 0.004% to 0.022%, which represents Severity of Sulfate Attack, Class 0 in accordance with Table 601-2 in Section 601 of the 2011 CDOT Standard Specifications. Because of the maximum levels for potable water in the City and County of Denver correspond to a Class 1 severity of sulfate attack, we recommend that all concrete used on the project be required to meet or exceed a Sulfate Resistance of Class 1.

In addition to the water soluble sulfate and pH measurements, the soluble chloride concentration ranged from 0.0385% to 0.2039% and the average resistivity ranged from 294 ohm-cm to 533 ohm-cm. The resistivity, pH, chloride and soluble sulfate concentrations should be used in conjunction with the CDOT Culvert Pipe Selection Policy to select appropriate culvert pipe materials.

5.3 Swell/Colidation Tests

Swell/Consolidation tests were conducted in general accordance with ASTM D4546 with a loading of 200 psf to determine the swell or consolidation potential of selected soil samples of the subsurface materials upon addition of water. The test results ranged from 0.5 to 2.0 percent at a depth of 3 to 5 feet. The MGPEC Pavement Design Standards state that special treatment is not required when speed limits are less than 35 miles per hour and swell measurements are less than 4 percent or when speed limits are more than 35 miles per hour and swell measurements are less than 2 percent. Subgrade preparation will be addressed in a later section of this report.

6.0 Traffic Loading

This section of Federal Boulevard is an urban arterial. Traffic volumes and vehicle classifications for mainline Federal Boulevard and 8th Avenue were supplied by TSH and the City and County of Denver. Multiple day traffic counts and vehicle classifications were taken at locations near 8th Avenue and 10th Avenue. Using the vehicle classifications and the vehicle loading factors from the MGPEC Pavement Design Standards, coupled with the CDOT growth factor for this roadway, 20-year ESALs for HMA and 30-Year PCCP ESALS were calculated. The calculations provided 20-year and 30-year ESAL values more than twice the predicted values from the CDOT web page. This difference is believed to be caused by the difference in ESAL values for the individual vehicles used by MGPEC.

The 8th Avenue intersection is the busiest intersection in this project area. Present and future traffic volumes were obtained from TSH and used to calculate the additional ESAL loading contributed by the traffic on 8th Avenue. The average volume from the east and west side of Federal was used to calculate the 8th Avenue contribution to the intersection ESALs using the average ESAL value from the Federal Boulevard ESAL calculations.

For the revised report, the traffic loading calculations were updated to address the construction year of 2017 instead of 2012.

Complete calculations for 2012 and updated traffic loading based on the build year of 2017 are presented in Appendix C and summarized in Table 2.

Table 2 – ESAL Loading

	CCD*	CCD*
	20-Year HMA ESALs	30-Year PCCP ESALs
Build Year	2012 / 2017	2012 / 2017
NB Federal N/O 10th Ave	7,034,489 / 7,365,110	10,847,576 / 11,357,412
Federal Blvd. / 8th Ave Intersection	8,011,694 / 8,461,483	12,410,055 / 13,768,087
8th Avenue	977,205 / 1,096,373	1,562,479 / 2,410,675

* The highest loading from the sections on Federal Boulevard was used for pavement designs.

7.0 Pavement Thickness Design

The Federal Boulevard pavement thickness was designed using both the MGPEC program and the programs recommended by the 2011 CDOT Pavement Design Manual. The CDOT Manual uses DARWin Version 3.1 for design of HMA pavements and the FHWA 1998 Supplement to the AASHTO pavement design guide for PCC pavements. All of these design programs follow the 1993 AASHTO Pavement Design Guide. The MGPEC program modifies soil support values for PCCP and the reliability for traffic and soil support for HMA.

Table 3 - Mainline Federal Blvd. Pavement Thickness Designs

NB Federal N/O 10th Ave	CCD ESALs 20-Yr ESALs HMA over 6" ABC (inches)	CCD 30-yr ESALs PCCP over 6" ABC (inches)
Build Year	2012 / 2017	2012 / 2017
MGPEC Design Program	11.5 / 11.5	10.0 / 10.0
CDOT Pavement Guide	12.5 / 12.5	10.5 / 10.5*

*In accordance with the CDOT Design Manual, 1/4 inch was added to the PCCP of 10.25 and the thickness rounded up to 10.5 inches for the PCCP.

Six inches of ABC should be placed under both the HMA or the PCC pavement for either MGPEC or CDOT thickness designs and all concrete pavements should contain 1.5 inch dowels in the transverse joints and No. 6 tie bars in the longitudinal joints. The MGPEC Pavement Design thickness was 10.0 inches of HMA with 12 inches of stabilized base, so if only 6 inches of ABC stabilization is used instead of the stabilized base an additional 1.5 to 2.0 inches of HMA was added to provide an equivalent pavement section over the 6 inches of ABC.

A separate thickness design was performed for the intersection of Federal Blvd. and 8th Avenue.

Table 4 - 8th Avenue /Federal Blvd. Intersection Pavement Thickness

Intersection	CCD ESALs 20-Yr ESALs HMA over 6" ABC (inches)	CCD 30-yr ESALs PCCP over 6" ABC (inches)
MGPEC Design Program	12.5 / 12.5	10.5 / 10.5
CDOT Pavement Guide	12.75 / 12.75	11.0 / 11.0*

*The program output was 10.54 which with 0.25 added would be 10.79 rounded / 11.0d to 11.0.

Complete pavement design calculations and program outputs are presented in Appendix D.

Because of problems on the Federal Boulevard project south of 6th Avenue with obtaining compaction over shallow utilities, and to prevent contamination of the ABC, we recommend that a geotextile conforming to the AASHTO M288 Class 1 Separator Geotextile be placed between the compacted subgrade and the ABC Class 6. The separator geotextile shall be installed in accordance with Section 420.07 of the CDOT 2011 Standard Specifications and shall be in compliance with the requirements of Section 712.08 of the CDOT Standard Specifications.

No traffic data was available for the other intersecting streets along this corridor. We recommend that the tie-in to the new mainline pavement should meet the default requirements based on classification found in CCD Standard Drawing 12.6.

8.0 Asphalt Binder and Mix Recommendations

The binder selection program LTPPBind was used to determine the binder grades to provide a 98% reliability binder for both the top and lower lifts for this project area. Based on the LTPPBind output, the 98% reliability binder for lifts below 2 inches is PG 64-22, and the binder grade for the top lift is PG 76-28 after bumping for the high volume and stop and go traffic. The output from the LTPP Binder Selection Program is presented in Appendix D.

If the HMA option is chosen for the mainline, we recommend that an asphalt mix meeting Grading S (100) containing unmodified performance graded binder PG 64-22 be used for the lower lifts of asphalt pavement. For the top lift we recommend that SMA with fibers containing performance graded binder PG 76-28 be used. HMA should be placed using 2 to 3 inch lifts in accordance with both CDOT and MGPEC specifications.

We recommend the tie-ins to local streets be constructed using an asphalt mix meeting Grading S(100) containing unmodified performance graded binder PG 64-22.

9.0 Life Cycle Cost Analysis

Since the thickness of the pavements did not change, no recalculation of the life cycle costs was performed for the 2017 build year update.

A life cycle cost analysis (LCCA) was performed for the pavement on Federal Boulevard comparing the 12.0 inch HMA option with a 10.5 inch PCC pavement option. Since either the HMA or PCC pavements will be required to have the same subgrade treatment; compacted subgrade, separator geotextile and 6.0 inches of ABC Class 6 base course, no costs were incorporated into the LCCA for base or subbase treatment.

The HMA pavement will consist of 10.0 inches of mix conforming to S(100) and containing PG 64-22. The top 2.0 inches of the HMA pavement will be constructed using SMA with fibers and containing PG 76-28.

The concrete options will consist of 10.5 inches of PCC pavement. Table 5 lists the costs used for these major paving materials.

Table 5 - Pavement Materials Costs for LCCA

	Low Cost	Most Likely Cost	High Cost
S(100)	$50/ton	$55/ton	$60/ton
SMA	$75/ton	$85/ton	$95/ton
PCCP	$3.50/ yd^2-in	$4.00/ yd^2-in	$4.50/ yd^2-in

Appendix E presents the User Cost calculations from the Work Zone Program for future rehabilitation work along with the future traffic volumes used as input to the Work Zone program.

The quantities and costs for the one mile section of Federal Boulevard are presented in Appendix F along with the output report from the FHWA RealCost program. The life cycle cost was performed in accordance with the CDOT 2012 Pavement Design Guide. Table 6 lists a cost comparison for one mile of Federal Boulevard using either the 12 inches of HMA or the 10.5 inches of PCCP using the most likely cost for materials from the life cycle cost analysis.

Table 6 - Comparison of Initial Costs Using HMA versus PCC Pavement

Mainline Federal Boulevard	HMA Cost	PCC Cost
Initial Construction Cost	$2,726,089	$2,891,307
% difference = (higher - lower) / (lower) => 6.1% lower initial cost with HMA Pavement		

* cost in thousands for one mile of Federal Boulevard

CDOT uses the results at the 75th percentile from the 40-Year life cycle cost analysis to determine the pavement type. If the results show that one pavement material type is more than 10% below the other, that pavement type is recommended unless there are other considerations that are weighed more than the life cycle cost. Table 7 presents the results of the 40-Year Life Cycle Cost Analysis for this project.

Table 7 - Comparison of HMA and PCC Pavement at the 75th Percentile

	HMA Agency Cost	HMA User Cost	PCC Agency Cost	PCC User Cost
75th Percentile	$4,434.42	$16.18	$3,400.17	$6.79
% difference = (higher - lower) / (lower) => 30.6% lower with PCC Pavement				

* cost in thousands for one mile of Federal Boulevard

10.0 Pavement Type Recommendation

As can be seen in Table 7, the PCC option is more than 10% lower than the HMA option. We recommend that the mainline pavement for this section of Federal Boulevard be constructed using 10.5 inches of Portland Cement Concrete Pavement with six inches of ABC Class 6.

We recommend that the intersection of Federal Boulevard and 8th Avenue be constructed using 11.0 inches of PCC pavement over six inches of ABC Class. A Pavement Stabilization Parameter Table is included in Appendix F showing the various layers and thickness requirements for the pavement sections on Federal Boulevard.

11.0 Subgrade Preparation

Following removal of the existing pavement and adjustment of the subgrade to the proper elevation, the exposed subgrade area should then be scarified to a depth of 6 inches, brought to near optimum moisture, and recompacted. In the widening area to the east of existing Federal Boulevard, both CDOT and MGPEC specifications recommend 2 feet of subexcavation and recompaction prior to placing new base course and pavement. This requirement is based on swell potential and also soil plastic indices. The required percent of relative compaction should be in conformance with Section 203.07 of the CDOT Standard Specifications.

The blow counts during boring varied from 5 to 20 indicating variable subgrade stiffness. This roadway also contains a large number of buried utilities which can have been placed various fill materials and also varying compactive efforts. There may also be areas which will require muck excavation. We recommend that a quantity of muck excavation be added to the bid items to address possible very wet locations.

The pavement subgrade should be proof rolled with a heavily loaded pneumatic-tire vehicle. Areas which deform more than 0.5 inch under heavy wheel loads should be reworked or replaced if necessary to achieve a stable subgrade prior to paving. ABC or other select material may be used to replace the unstable materials. We recommend that proof rolling and compaction tests be performed by the representative of a Registered Professional Engineer.

12.0 Drainage

The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of pavement. Proper design of drainage should include prevention of ponding of water on or immediately adjacent to pavement areas. All landscape sprinkler heads adjacent to pavement areas should be frequently checked for leaks and maintained in good working order. Over-spray from sprinklers should be minimized.

13.0 Limitations

This report has been prepared in accordance with generally accepted geologic and geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from our exploratory borings drilled at the locations indicated on Figure 2a -c.

The nature and extent of subsurface variations across the site may not become evident until excavation is performed. If during construction, fill, soil, bedrock or water conditions appear to be different from those described herein, this office should be advised immediately so re-evaluation of the recommendations can be made. We recommend on-site observation of excavations and foundation bearing strata by a representative of the geotechnical engineer.

Appendix A- Engineering Geology Sheets and Boring Logs

601 FEDERAL | 707 FEDERAL | 745 FEDERAL | 749 FEDERAL

PAVEMENT MARKING & SYMBOLS
SEE SIGNING & STRIPING SUBSET

TS
S3

FEDERAL BLVD
WEST LIP HCL

WATER SERVICES TO BE REPLACED (TYP)
SEE WATER LINE SUBSET

POB
200+17.00

PI
201+96.14

200+17

BEGIN PROFILE STA 200+30.00

BEGIN PROJECT STA 4+17.82

FEDERAL BLVD HCL

FEDERAL BLVD

MATCHLINE STA 8+50

4+00 | 5+00 | 6+00 | 7+00 | 8+00

201+00 | 202+00 | 203+00 | 204+00

P-01

7TH AVE

PROPOSED FIRE HYDRANT
SEE WATER LINE SUBSET

690 FEDERAL | 710 FEDERAL | 724 FEDERAL | 730 FEDERAL | 2970 W SEVERN PL

FEDERAL BLVD WEST LIP PGL

EXISTING GRADE

P-01
MC=25.6%
#200=79%
LL=51
PI=33
PL=18
R-VALUE=6
AASHTO: A-7-6 (23)
USCS: CH

200+38.97 (4+35) 2.00 2.00
202+00 (6+00) 2.00 2.00
202+75 (6+75) 3.50 2.00
204+00 (8+00) 3.50 2.00

5260 | 5255 | 5250 | 5245 | 5240 | 5235

199+50 | 200+00 | 201+00 | 202+00 | 203+00 | 204+00 | 204+50

KEY MAP

12TH AVE | 10TH AVE | 9TH AVE | 8TH AVE | 7TH AVE
7 | 6 | 5 | 4 | 3 | 2 | 1
HOLDEN PL | 11TH AVE | BARBERRY PL | SEVERN PL

LEGEND

- ASPHALT
- USCS HIGH PLASTICITY CLAY
- USCS CLAYEY SAND
- USCS SILTY SAND
- FILL WITH SAND AS MAJOR SOIL
- FILL (MADE GROUND)
- FILL WITH CLAY AS MAJOR SOIL
- USCS LOW PLASTICITY CLAY
- LOW PLASTICITY SANDY CLAY
- FILL WITH GRAVEL AS MAJOR SOIL
- USCS SANDY SILT

BORING LOCATION

TYPICAL TEST HOLE LOG

BORING NO.
GRAPHIC MATERIAL DESCRIPTION
GROUND WATER
PENETRATION RESISTANCE (BLOWS PER FOOT OR INCHES OF PENETRATION)
LAB TEST RESULTS

N
20
0 40

Yeh and Associates, Inc.
Consulting Engineers & Scientists

F.I.R. SUBMITTAL - JULY 29, 2011

Mike Walz
10/12/2011
8:04:54 AM
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Last Modification Date: 10/11/2011 Init.: MJW
Drawing File Name: 1102188-02-Federal Plan - YA EngGeo.dgn
Horizontal Scale: 1:40 Vert. Scale: As Noted

Sheet Revisions

Date:	Comments	Init.

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Denver, CO. 80202

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DOT
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Region 6 xxx

As Constructed
No Revisions:
Revised:
Void:

FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 3+50 TO 8+50

Designer:	RLF	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOLOGY	Subset Sheets:	1 of 7

Project No./Code
CC 0881-025
SA 18365
CE02011

Sheet Number X

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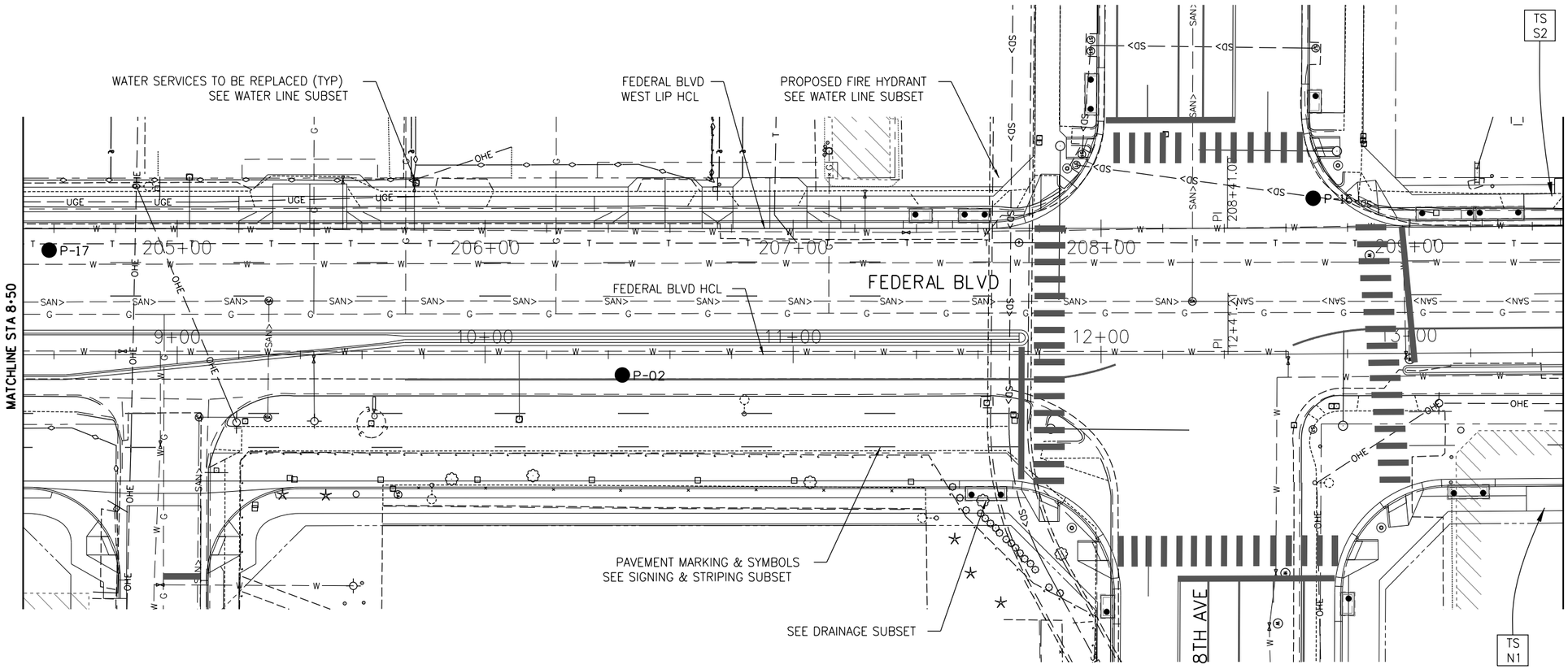

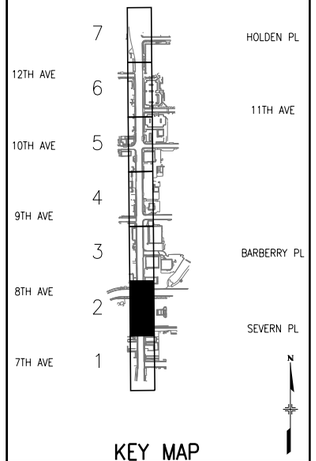

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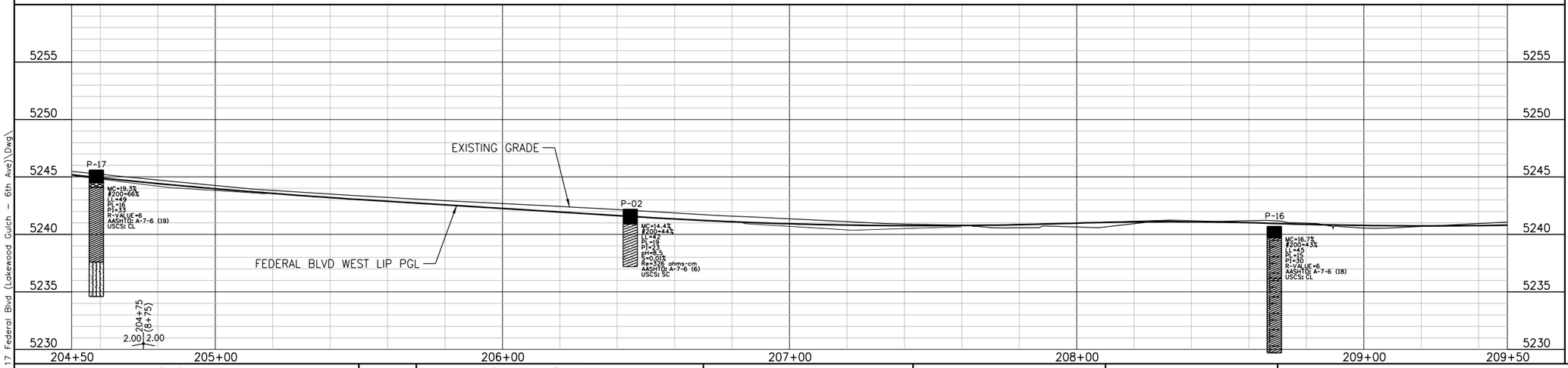

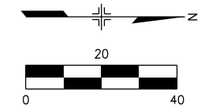

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Mike Walz
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Last Modification Date: 10/11/2011 Init.: MJW
Drawing File Name: 1102188-02-Federal Plan - YA EngGeo.dgn
Horizontal Scale: 1:40 Vert. Scale: As Noted

Sheet Revisions

Date:	Comments	Init.

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Region 6 xxx

As Constructed

No Revisions:

Revised:

Void:

FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 8+50 TO 13+50

Designer:	RLF	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOLOGY	Subset Sheets:	2 of 7

Project No./Code
CC 0881-025
SA 18365
CE02011
Sheet Number X

815 FEDERAL | 823 FEDERAL | 859 FEDERAL | 869 FEDERAL | 877 FEDERAL | 891 FEDERAL

TS S2

FEDERAL BLVD WEST LIP HCL

WATER SERVICES TO BE REPLACED (TYP)
SEE WATER LINE SUBSET

FEDERAL BLVD HCL

FEDERAL BLVD

MATCHLINE STA 13+50

MATCHLINE STA 18+50

P-03 P-15 P-04

210+00 211+00 212+00 213+00 214+00

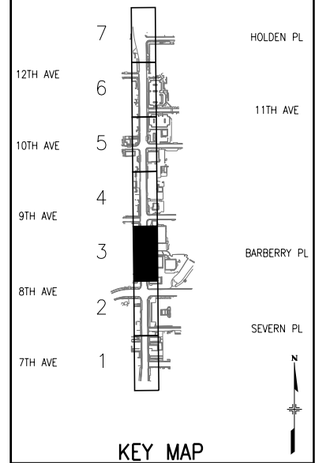
14+00 15+00 16+00 17+00 18+00

BARBERRY PL

PAVEMENT MARKING & SYMBOLS
SEE SIGNING & STRIPING SUBSET

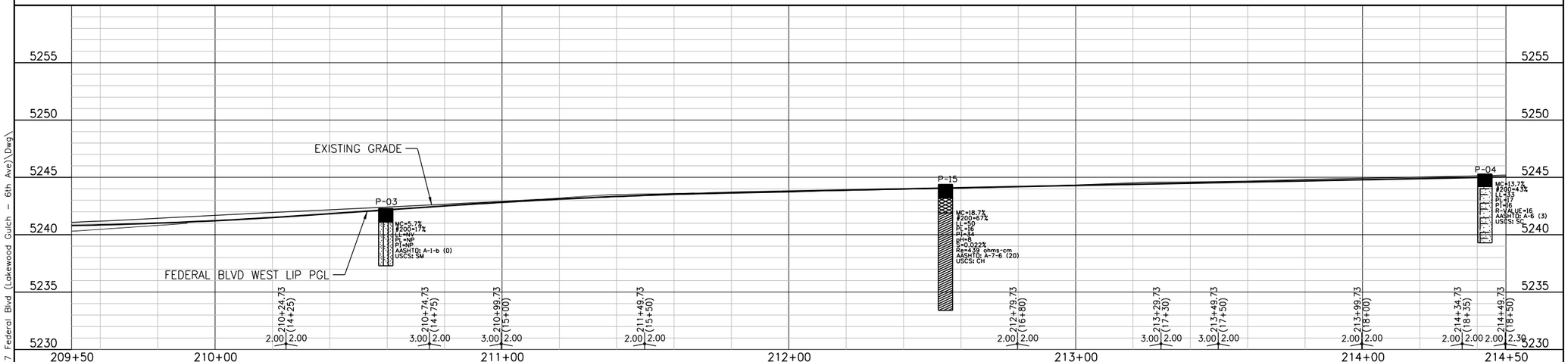
SEE DRAINAGE SUBSET

TS N1



KEY MAP

830 FEDERAL | 888 FEDERAL



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Mike Walz
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Last Modification Date: 10/11/2011 Init.: MJW
Drawing File Name: 1102188-02-Federal Plan - YA EngGeo.dgn
Horizontal Scale: 1:40 Vert. Scale: As Noted

Sheet Revisions

Date:	Comments	Init.

City and County of Denver
Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
2000 South Holly Street
Denver, CO 80222
Phone: 303-757-9914
FAX: 303-757-9053
Region 6 xxx

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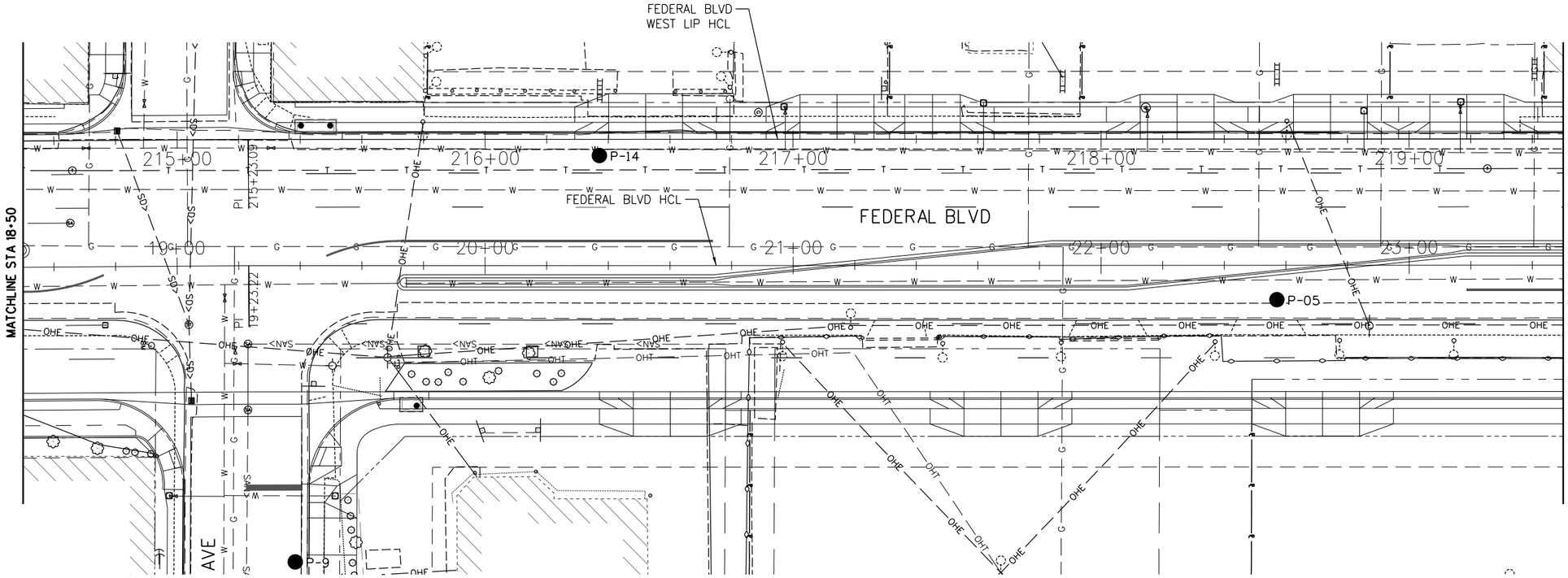
FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 13+50 TO 18+50

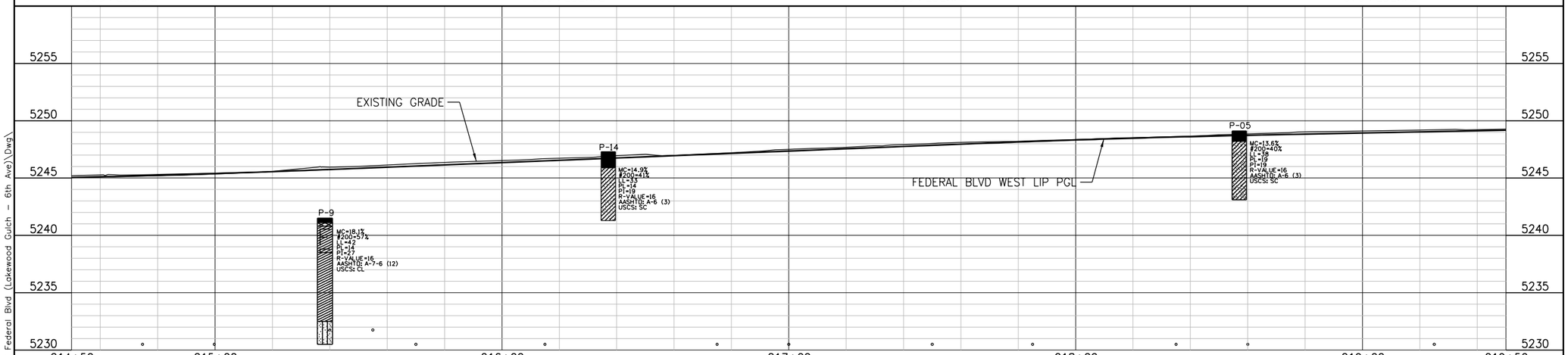
Designer:	RLF	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOLOGY	Subset Sheets:	3 of 7

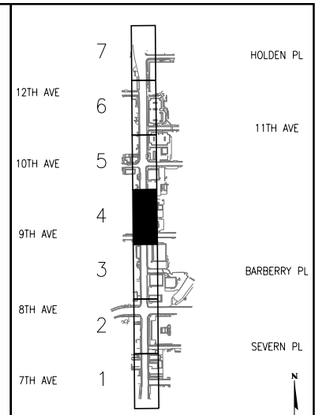
Project No./Code
CC 0881-025
SA 18365
CE02011
Sheet Number X

891 FEDERAL | 903 FEDERAL | 913 FEDERAL | 935 FEDERAL | 947 FEDERAL | 963 FEDERAL

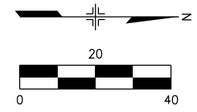


888 FEDERAL | 900 FEDERAL | 950 FEDERAL | 970 FEDERAL





KEY MAP



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Phone: 303-757-9914
FAX: 303-757-9053
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 18+50 TO 23+50

Designer:	RLF	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOLOGY	Subset Sheets:	4 of 7

Project No./Code
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SA 18365
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Sheet Number X

969-975 FEDERAL | 995 FEDERAL | 1005 FEDERAL | 1015 FEDERAL | 1023 FEDERAL | 1041 FEDERAL

TS S1

PROPOSED FIRE HYDRANT
SEE WATER LINE SUBSET

FEDERAL BLVD
WEST LIP HCL

WATER SERVICES TO BE REPLACED (TYP)
SEE WATER LINE SUBSET

MATCHLINE STA 23+50

MATCHLINE STA 28+50

220+00 | 221+00 | 222+00 | 223+00 | 224+00 | 24+00 | 25+00 | 26+00 | 27+00 | 28+00

P-13

P-06

FEDERAL BLVD HCL

FEDERAL BLVD

SEE DRAINAGE SUBSET

10TH AVE

TS N2

PAVEMENT MARKING & SYMBOLS
SEE SIGNING & STRIPING SUBSET

KEY MAP

7 | 6 | 5 | 4 | 3 | 2 | 1

12TH AVE | 10TH AVE | 9TH AVE | 8TH AVE | 7TH AVE

HOLDEN PL | 11TH AVE | BARBERRY PL | SEVERN PL

990 FEDERAL | 1000 FEDERAL | 1030 FEDERAL

EXISTING GRADE

FEDERAL BLVD WEST LIP PGL

P-13

P-06

MC=11.3%
#200=34%
LL=NV
PL=NP
PI=NP
AASHTO: A-2-4 (0)
USCS: SM

5260 | 5255 | 5250 | 5245 | 5240 | 5235

219+90 (23+90) 2.00 2.00
220+80 (24+80) 2.00 2.00
221+45 (25+45) 2.00 3.30
221+55 (25+55) 2.00 3.30
221+80 (25+80) 1.50 3.30
222+60.55 (26+60) 1.50 3.30
223+00.55 (27+00) 1.50 2.50
223+25.55 (27+25) 1.50 2.00
223+55.55 (27+50) 2.00 1.50
224+00.55 (28+00) 3.50 1.50
224+11.55 (28+10) 3.50 1.50

219+50 | 220+00 | 221+00 | 222+00 | 223+00 | 224+00 | 224+50

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Mike Walz
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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 23+50 TO 28+50

Designer:	RLF	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOLOGY	Subset Sheets:	5 of 7

Project No./Code
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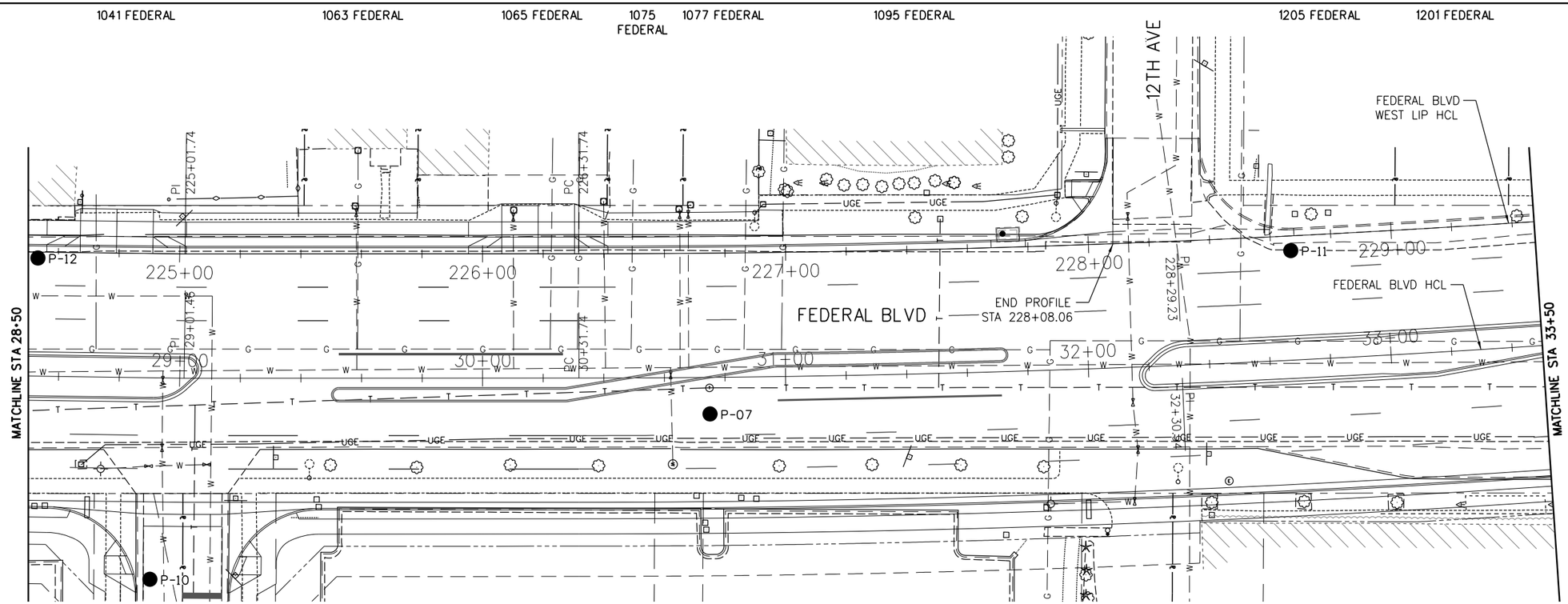
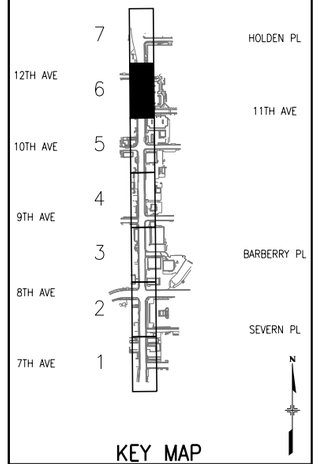
CE02011
Sheet Number X





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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 28+50 TO 33+50

Designer:	RLF	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOLOGY	Subset Sheets:	6 of 7

Project No./Code
CC 0881-025
SA 18365
CE02011
Sheet Number X

1201 FEDERAL

1225 FEDERAL

1251 FEDERAL

FEDERAL BLVD WEST LIP HCL

SEE DRAINAGE SUBSET

FEDERAL BLVD HCL

END PROJECT STA 35+95.25

MATCHLINE STA 33+50

FEDERAL BLVD

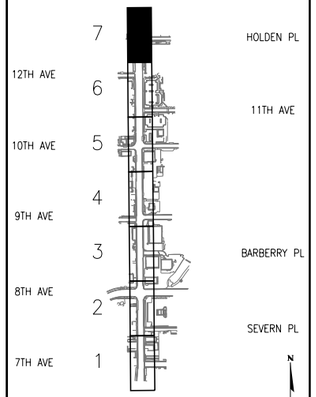
HOLDEN PL

P-08

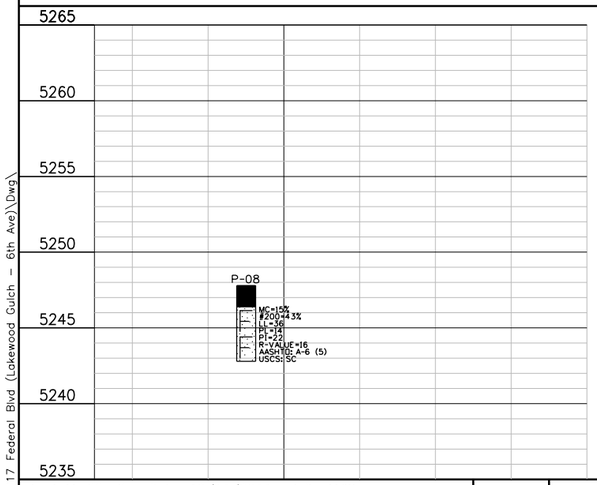
TS N3

1200 FEDERAL

2855 W HOLDEN PL



KEY MAP



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FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
ENGINEERING GEOLOGY
FEDERAL BLVD - 33+50 TO 38+50

Designer:	RLF	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOLOGY	Subset Sheets:	7 of 7

Project No./Code
CC 0881-025
SA 18365
CE02011
Sheet Number X

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-01**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 5.5 ft
Ground Elevation: 5251.7 ft
Location: 39 43.662, -105 01.505
Coordinates: N: 2,690,712.4 E: 6,134,377.7

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.2 ft. Asphalt Pavement 13.5 inches.	
5250								**1.2 - 5.5 ft. sandy CLAY**, brown to dark brown, moist, loose.	MC= 25.6 % #200= 73 % LL= 55 PL= 23 PI= 32 R-Value= 6 AASHTO: A-7-6 (23) USCS: CH
					3/4	7			
	5				4/5	9			
								Bottom of Hole at 5.5 ft.	
5245									
	10								
5240									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-02**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 5.0 ft
Ground Elevation: 5242.2 ft
Location: 39 43.728, -105 01.505
Coordinates: N: 2,691,116.0 E: 6,134,374.1

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.3 ft. Asphalt Pavement 15 inches.	
5240					5/6	11		**1.3 - 5.0 ft. clayey SAND FILL** with gravel, brown to dark brown, damp, loose to medium dense.	MC= 14.4 % #200= 44 % LL= 42 PL= 19 PI= 23 pH= 8.5 S= 0.01 % Re= 326 ohms-cm AASHTO: A-7-6 (6) USCS: SC Chloride=0.2039%
	5				4/4	8		Bottom of Hole at 5.0 ft.	
5235									
	10								
5230									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-03**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 5.0 ft
Ground Elevation: 5242.3 ft
Location: 39 43.795, -105 01.504
Coordinates: N: 2,691,530.9 E: 6,134,370.7

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.2 ft. Asphalt Pavement 14 inches.	
								1.2 - 5.0 ft. silty SAND FILL with gravel, black mottled with brown, damp, loose to medium dense.	MC= 5.7 % #200= 17 % LL= NV PL= NP PI= NP AASHTO: A-1-b (0) USCS: SM
5240					6/8	14			
					4/4	8			
	5							Bottom of Hole at 5.0 ft.	
5235									
	10								
5230									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-04**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 6.0 ft
Ground Elevation: 5245.3 ft
Location: 39 43.859, -105 01.504
Coordinates: N: 2,691,914.1 E: 6,134,367.5

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
5245								**0.0 - 1.1 ft. Asphalt Pavement** 13 inches.	
								1.1 - 6.0 ft. clayey SAND FILL, dark brown, damp, loose to medium dense, angular.	MC= 13.7 % #200= 43 % LL= 33 PL= 17 PI= 16 R-Value= 16 AASHTO: A-6 (3) USCS: SC
					7/3	10			
	5								
5240					5/7	12			
								Bottom of Hole at 6.0 ft.	
	10								
5235									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-05**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 6.0 ft
Ground Elevation: 5249.1 ft
Location: 39 43.927, -105 01.505
Coordinates: N: 2,692,328.4 E: 6,134,362.6

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.9 ft. Asphalt Pavement 11.5 inches.	
								0.9 - 6.0 ft. clayey SAND with gravel, brown, damp, medium dense.	MC= 13.6 % #200= 40 % LL= 38 PL= 19 PI= 19 R-Value= 16 AASHTO: A-6 (3) USCS: SC
					4/8	12			
5245									
	5				7/8	15			
								Bottom of Hole at 6.0 ft.	
5240									
	10								
5235									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-06**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 6.0 ft
Ground Elevation: 5250.4 ft
Location: 39 43.996, -105 01.504
Coordinates: N: 2,692,739.7 E: 6,134,359.5

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
5250								**0.0 - 0.5 ft. Asphalt Pavement** 6.5 inches.	
								0.5 - 1.2 ft. Base Course 7 inches.	
								1.2 - 6.0 ft. silty SAND FILL, gray - brown, damp, loose.	MC= 11.3 % #200= 34 % LL= NV PL= NP PI= NP AASHTO: A-2-4 (0) USCS: SM
					4/4	8			
	5								
5245					4/5	9			
								Bottom of Hole at 6.0 ft.	
	10								
5240									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-07**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 6.0 ft
Ground Elevation: 5250.9 ft
Location: 39 44.062, -105 01.506
Coordinates: N: 2,693,146.7 E: 6,134,359.3

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
5250								**0.0 - 1.3 ft. Asphalt Pavement** 15 inches.	
					5/7	12		**1.3 - 6.0 ft. silty SAND FILL**, brown - black, damp, loose to medium dense.	MC= 10.8 % #200= 30 % LL= NV PL= NP PI= NP AASHTO: A-2-4 (0) USCS: SM
	5				3/3	6			
5245								Bottom of Hole at 6.0 ft.	
	10								
5240									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-08**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/30/2011
Drill Bit:
Casing:
Weather:

Total Depth: 5.0 ft
Ground Elevation: 5247.8 ft
Location: 39 44.108, -105 01.508
Coordinates: N: 2,693,461.5 E: 6,134,361.0

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/30/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.4 ft. Asphalt Pavement 16.5 inches.	
					4/6	10		**1.4 - 5.0 ft. clayey SAND FILL** with calcite veins, brown-gray, damp, loose.	MC= 15 % #200= 43 % LL= 36 PL= 14 PI= 22 R-Value= 16 AASHTO: A-6 (5) USCS: SC
5245									
					3/3	6			
	5							Bottom of Hole at 5.0 ft.	
5240									
	10								
5235									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-09**
Sheet 1 of 1

Boring Began: 8/30/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 11.0 ft
Ground Elevation: 5241.5 ft
Location: 39 43.873, -105 01.488
Coordinates: N: 2,692,010.5 E: 6,134,450.7

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.4 ft. Asphalt Pavement 4.5 inches.	
								0.4 - 0.7 ft. Base Course 4 inches.	
								0.7 - 3.0 ft. sandy CLAY FILL, brown - white, moist, stiff.	MC= 18.1 % #200= 57 % LL= 42 PL= 15 PI= 27 AASHTO: A-7-6 (12) USCS: CL
5240					4/5	9			
								3.0 - 9.0 ft. CLAY, brown, moist, very stiff.	
	5				6/9	15			
5235									
								9.0 - 11.0 ft. silty SAND medium grain, dark gray, damp, medium dense.	
	10				8/8	16			
								Bottom of Hole at 11.0 ft.	
5230									

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-10**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 11.0 ft
Ground Elevation: 5251.8 ft
Location: 39 44.032, -105 01.495
Coordinates: N: 2,692,962.0 E: 6,134,415.7

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.6 ft. Asphalt Pavement 7.25 inches.	
								0.6 - 8.0 ft. clayey SAND FILL, brown, damp, loose.	MC= 11.9 % #200= 38 % LL= 29 PL= 19 PI= 10 pH= 8.3 S= 0.004 % R-Value= 16 Re= 533 ohms-cm AASHTO: A-4 (0) USCS: SC Chloride=0.0684%
5250					3/3	6			
	5				4/4	8			
5245									
								8.0 - 11.0 ft. sandy CLAY, brown, moist, very stiff.	
	10				9/11	20			
								Bottom of Hole at 11.0 ft.	
5240									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-11**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 6.0 ft
Ground Elevation: 5249.3 ft
Location: 39 44.094, -105 01.515
Coordinates: N: 2,693,337.6 E: 6,134,303.7

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.3 ft. Asphalt Pavement 16 inches.	
								1.3 - 6.0 ft. sandy CLAY with gravel, brown-gray, moist, stiff.	MC= 20.6 % #200= 65 % LL= 47 PL= 16 PI= 31 R-Value= 6 AASHTO: A-7-6 (18) USCS: CL
					4/7	11			
5245	5				5/4	9			
								Bottom of Hole at 6.0 ft.	
5240	10								
5235									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-12**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 6.0 ft
Ground Elevation: 5251.9 ft
Location: 39 44.027, -105 01.517
Coordinates: N: 2,692,924.1 E: 6,134,310.0

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.3 ft. Asphalt Pavement 14.5 inches.	
5250					4/5	9		**1.3 - 6.0 ft. silty SAND**, brown, damp, loose.	MC= 9 % #200= 29 % LL= NV PL= NP PI= NP pH= 8.2 S= 0.004 % Re= 294 ohms-cm AASHTO: A-2-4 (0) USCS: SM Chloride=0.1829%
	5				2/3	5			
								Bottom of Hole at 6.0 ft.	
5245									
	10								
5240									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-13**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 1.5 ft
Ground Elevation: 5250.6 ft
Location: 39 43.968, -105 01.514
Coordinates: N: 2,692,558.4 E: 6,134,321.8

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
5250								**0.0 - 1.2 ft. Asphalt Pavement** 14 inches.	
								1.2 - 1.5 ft. sandy GRAVEL FILL, black, damp, loose, encountered unmarked utility, boring abandoned.	
								Bottom of Hole at 1.5 ft.	
5245	5								
5240	10								

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-14**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 6.0 ft
Ground Elevation: 5247.3 ft
Location: 39 43.892, -105 01.515
Coordinates: N: 2,692,108.3 E: 6,134,317.8

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.4 ft. Asphalt Pavement 17 inches.	
5245					4/5	9		**1.4 - 6.0 ft. clayey SAND**, brown, damp to moist, stiff.	MC= 14.9 % #200= 41 % LL= 33 PL= 14 PI= 19 R-Value= 16 AASHTO: A-6 (3) USCS: SC
	5				6/8	14			
								Bottom of Hole at 6.0 ft.	
5240									
	10								
5235									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-15**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 11.0 ft
Ground Elevation: 5244.4 ft
Location: 39 43.831, -105 01.511
Coordinates: N: 2,691,725.7 E: 6,134,327.9

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 1.2 ft. Asphalt Pavement 14.5 inches.	
								1.2 - 2.5 ft. Base Course 15 inches, CONTAMINATED: strong petroleum oder.	
								2.5 - 11.0 ft. CLAY with calcareous deposits, brown with white, moist, stiff to very stiff.	MC= 18.7 % #200= 67 % LL= 50 PL= 16 PI= 34 pH= 8 S= 0.022 % Re= 439 ohms-cm AASHTO: A-7-6 (20) USCS: CH Chloride=0.0385%
					4/7	11			
5240	5								
					5/8	13			
5235	10				6/10	16			
								Bottom of Hole at 11.0 ft.	
5230									

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-16**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 11.0 ft
Ground Elevation: 5240.7 ft
Location: 39 43.764, -105 01.517
Coordinates: N: 2,691,339.8 E: 6,134,314.6

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
5240								**0.0 - 1.0 ft. Asphalt Pavement** 12.25 inches.	
								1.0 - 4.5 ft. CLAY FILL CONTAMINATED: strong petroleum oder, brown - black, moist, medium dense.	MC= 16.7 % #200= 43 % LL= 45 PL= 15 PI= 30 R-Value= 6 AASHTO: A-7-6 (18) USCS: CL
					7/6	13			
	5							**4.5 - 11.0 ft. sandy CLAY FILL** with debris: brick, coal, and organics, gray mottled with brown, moist, stiff to very stiff.	
5235					9/9	18			
	10				6/7	13			
5230								Bottom of Hole at 11.0 ft.	

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-17**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 11.0 ft
Ground Elevation: 5245.6 ft
Location: 39 43.697, -105 01.513
Coordinates: N: 2,690,929.5 E: 6,134,335.2

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
5245								**0.0 - 1.1 ft. Asphalt Pavement** 13.5 inches.	
								1.1 - 1.5 ft. Base Course 5 inches, CONTAMINATED: strong petroleum odor.	
					4/6	10		**1.5 - 8.0 ft. CLAY**, brown, damp, stiff.	MC= 19.3 % #200= 66 % LL= 49 PL= 16 PI= 33 R-Value= 6 AASHTO: A-7-6 (19) USCS: CL
	5								
5240					4/5	9			
								8.0 - 11.0 ft. sandy SILT, brown - gray, moist to wet, stiff.	
	10								
5235					4/4	8			
								Bottom of Hole at 11.0 ft.	

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

Appendix B- Laboratory Test Results

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 211 - 117 Project Name: Federal Blvd 6th Ave to Huron Date: 9/15/2011

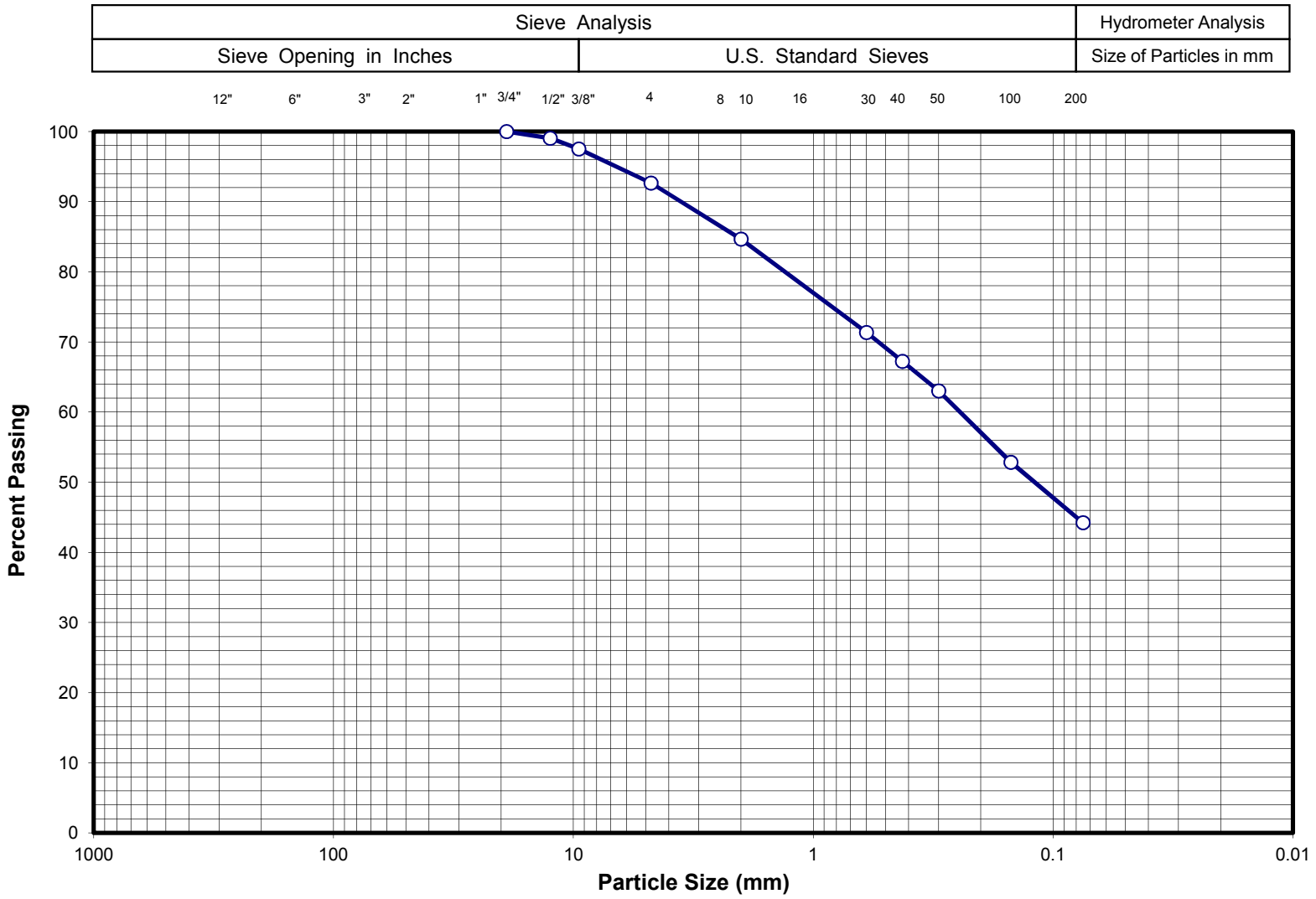
Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg			pH	Water Soluble Sulfate %	Resis-tivity ohm.cm	Chloride %	% Swell (+) / Consoli-dation (-)	R-Value	CLASSIFICATION	
Boring NO.	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI							AASHTO	USCS
P - 1	1.2-5	Bulk	25.6	–	–	–	73	55	23	32	–	–	–	–	–	–	A-7-6 (23)	CH
P - 1	2-3	CA	32.3	82.4	–	–	83	53	23	30	–	–	–	–	1.5	–	A-7-6 (26)	CH
P - 2	1.3-5	Bulk	14.4	–	7	49	44	42	19	23	8.5	0.010	326	0.2039	–	–	A-7-6 (6)	SC
P - 2	4-5	CA	15.8	104.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
P - 3	1.2-5	Bulk	5.7	–	33	50	17	NV	NP	NP	–	–	–	–	–	–	A-1-b (0)	SM
P - 4	1.1-5	Bulk	13.7	–	12	45	43	33	17	16	–	–	–	–	–	–	A - 6 (3)	SC
P - 4	5-6	CA	23.2	90.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–
P - 5	0.9-5	Bulk	13.6	–	5	55	40	38	19	19	–	–	–	–	–	–	A - 6 (3)	SC
P - 6	1.2-5	Bulk	11.3	–	5	61	34	NV	NP	NP	–	–	–	–	–	–	A-2-4 (0)	SM
P - 7	1.3-5	Bulk	10.8	–	2	68	30	NV	NP	NP	–	–	–	–	–	–	A-2-4 (0)	SM
P - 7	5-6	CA	12.8	98.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–
P - 8	1.4-5	Bulk	15.0	–	5	52	43	36	14	22	–	–	–	–	–	–	A - 6 (5)	SC
P - 8	1.5-2.5	CA	20.2	99.9	–	–	–	–	–	–	–	–	–	–	–	–	–	–
P - 9	0.7-5	Bulk	18.1	–	–	–	57	42	15	27	–	–	–	–	–	–	A-7-6 (12)	CL
P - 9	5-6	CA	31.2	81.3	–	–	69	43	16	27	–	–	–	–	0.8	–	A-7-6 (16)	CL
P - 10	0.6-5	Bulk	11.9	_	1	61	38	29	19	10	8.3	0.004	533	0.0684	–	–	A - 4 (0)	SC

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 211 - 117 Project Name: Federal Blvd 6th Ave North Date: 9/15/2011

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg			pH	Water Soluble Sulfate %	Resis-tivity ohm.cm	Chloride %	% Swell (+) / Consoli-dation (-)	R-Value	CLASSIFICATION	
Boring NO.	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI							AASHTO	USCS
P - 10	2-3	CA	12.0	99.2	0	71	29	NV	NP	NP	–	–	–	–	–	–	A-2-4 (0)	SM
P - 11	1.3-5	Bulk	20.6	–	–	–	65	47	16	31	–	–	–	–	–	–	A-7-6 (18)	CL
P - 11	2-3	CA	21.1	99.9	–	–	50	45	16	29	–	–	–	–	0.3	–	A-7-6 (10)	CL
P - 12	1.3-5	Bulk	9.0	–	5	66	29	NV	NP	NP	8.2	0.004	294	0.1829	–	–	A-2-4 (0)	SM
P - 14	1.4-5	Bulk	14.9	–	5	54	41	33	14	19	–	–	–	–	–	–	A - 6 (3)	SC
P - 14	1.4-2.4	CA	15.8	107.5	0	64	36	34	17	17	–	–	–	–	0.5	–	A - 6 (2)	SC
P - 15	2.5-5	Bulk	18.7	–	–	–	67	50	16	34	8.0	0.022	439	0.0385	–	–	A-7-6 (20)	CH
P - 15	5-6	CA	23.0	95.1	–	–	59	49	16	33	–	–	–	–	2.0	–	A-7-6 (16)	CL
P - 16	1-4.5	Bulk	16.7	–	10	47	43	45	15	30	–	–	–	–	–	–	A-7-6 (18)	CL
P - 16	3-4	CA	10.6	–	32	47	21	32	47	21	–	–	–	–	–	–	A-2-6 (0)	SC
P - 16	5-6	CA	11.6	98.4	6	67	27	NV	NP	NP	–	–	–	–	–	–	A-2-4 (0)	SM
P - 17	1.5-5	Bulk	19.3	–	–	–	66	49	16	33	–	–	–	–	–	–	A-7-6 (19)	CL
P - 17	5-6	CA	30.3	88.5	–	–	78	50	16	34	–	–	–	–	1.3	–	A-7-6 (26)	CH
Mix-1: (P-4)+(P-5)+(P-8)+(P-10)+(P-14)					6	57	37	31	15	16	–	–	–	–	–	16	A - 6 (2)	SC
Mix-2: (P-1)+(P-11)+(P-16)+(P-17)					3	38	59	48	17	31	–	–	–	–	–	6	A-7-6 (15)	CL
Mix-3: (P-1)+(P-9)+(P-11)+(P-15)+(P-17)					2	36	62	50	17	33	Proctor T99 (A)= 104.7 pcf @ 16.9%, Unconfined= 2721 psf						A-7-6 (18)	CH



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	99
⅜"	98
#4	93
#10	85
#40	67
#200	44

Gravel (%)	7	LL	42	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	49	PL	19	Sample ID:	P - 2
Fines (%)	44	PI	23	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 7 - 6 (6)				

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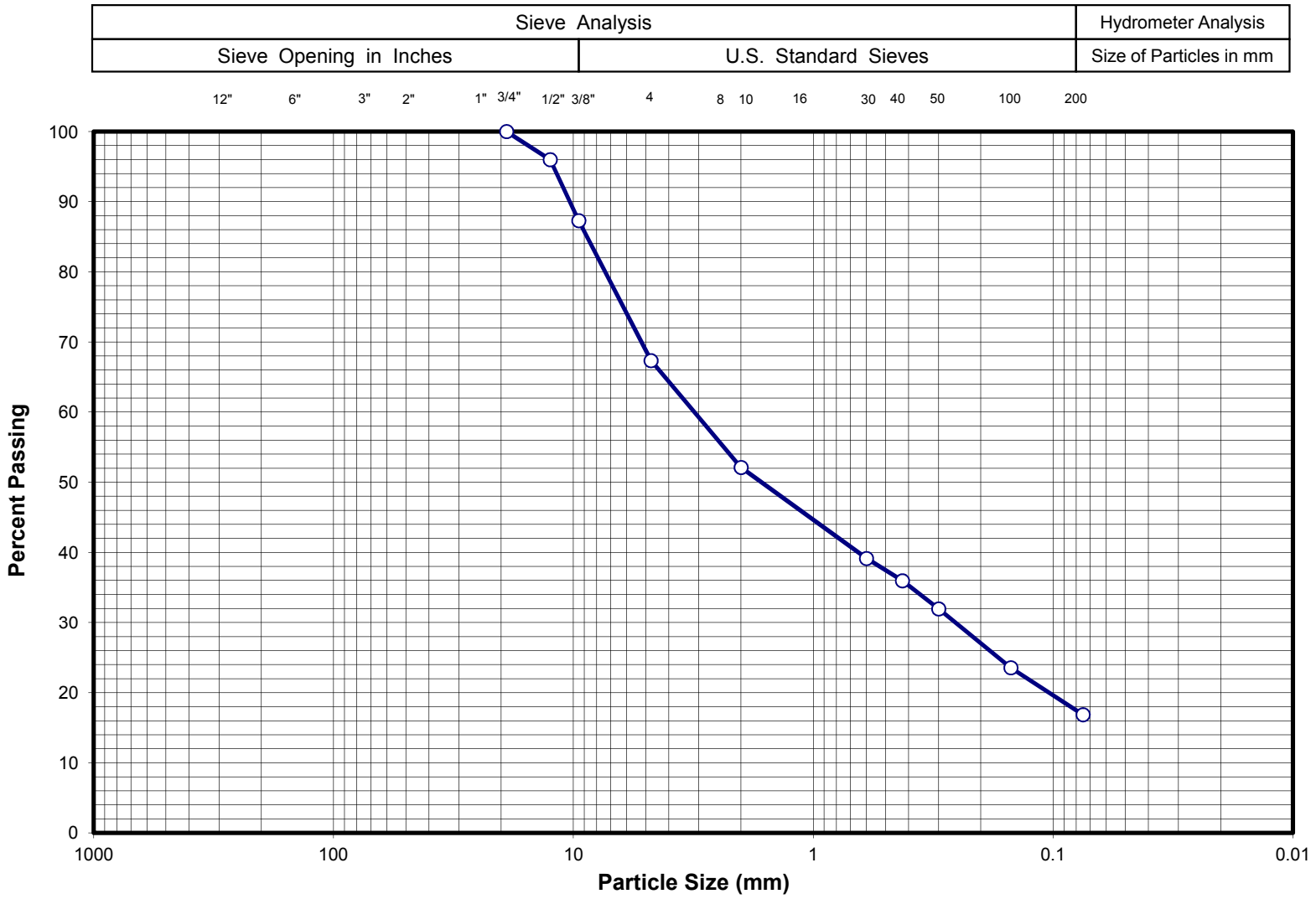
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	96
⅜"	87
#4	67
#10	52
#40	36
#200	17

Gravel (%)	33	LL	NV	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	50	PL	NP	Sample ID:	P -3
Fines (%)	17	PI	NP	Sample Depth (ft.):	0-5
Sample Description:	SM / A - 1 - b (0)				

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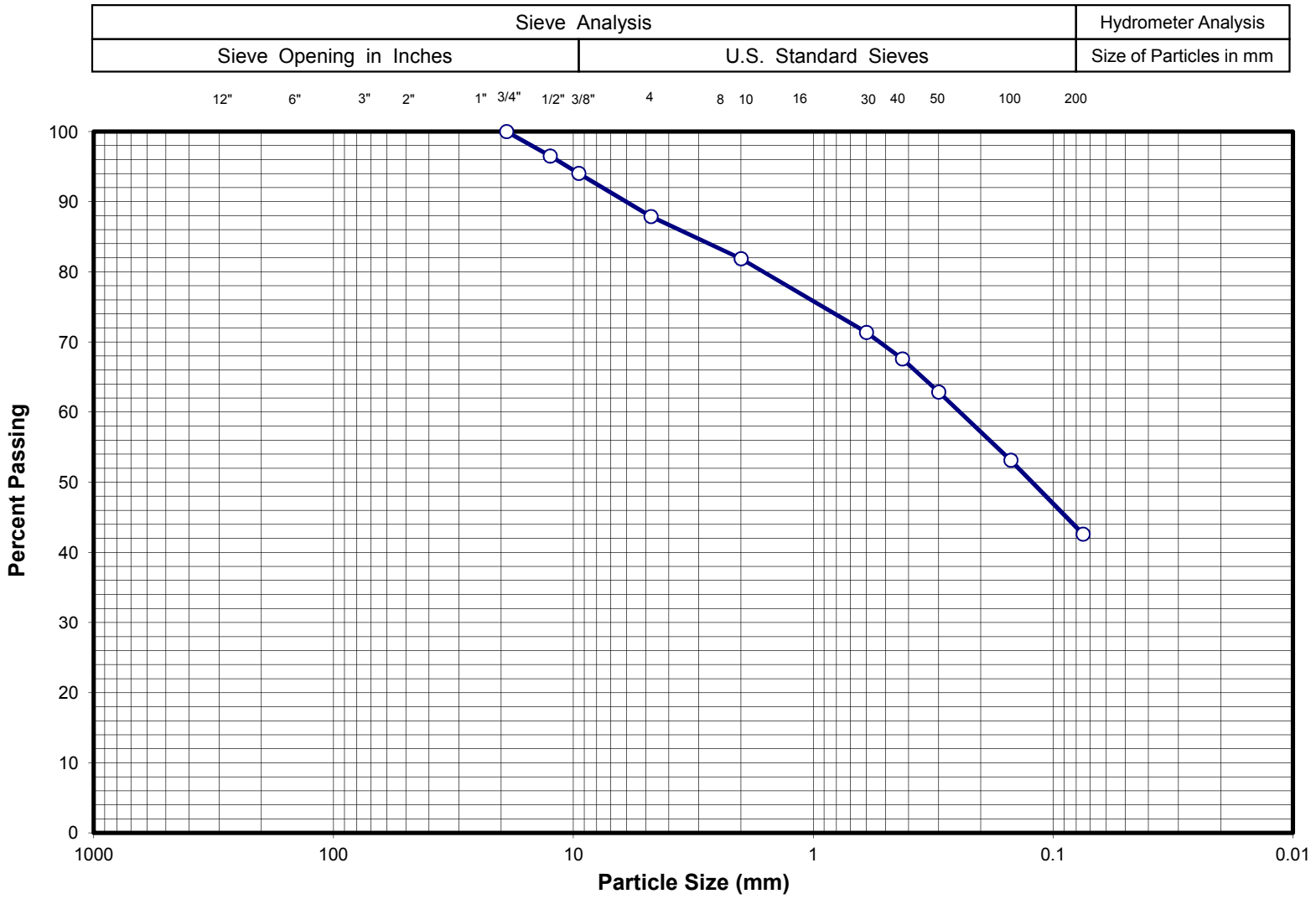
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	97
⅜"	94
#4	88
#10	82
#40	68
#200	43

Gravel (%)	12	LL	33	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	45	PL	17	Sample ID:	P -4
Fines (%)	43	PI	16	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 6 (3)				

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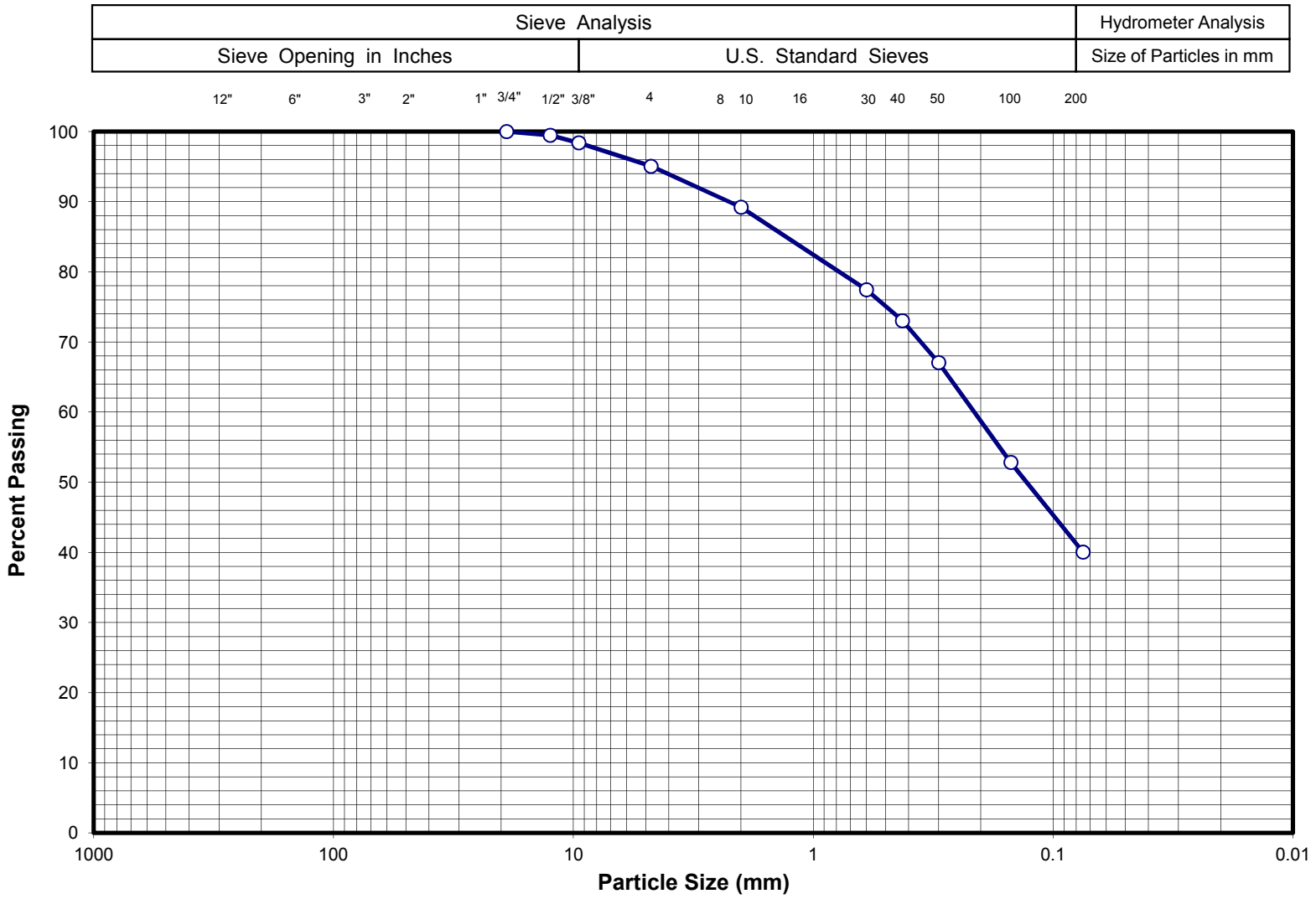
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	99
⅜"	98
#4	95
#10	89
#40	73
#200	40

Gravel (%)	5	LL	38	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	55	PL	19	Sample ID:	P -5
Fines (%)	40	PI	19	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 6 (3)				

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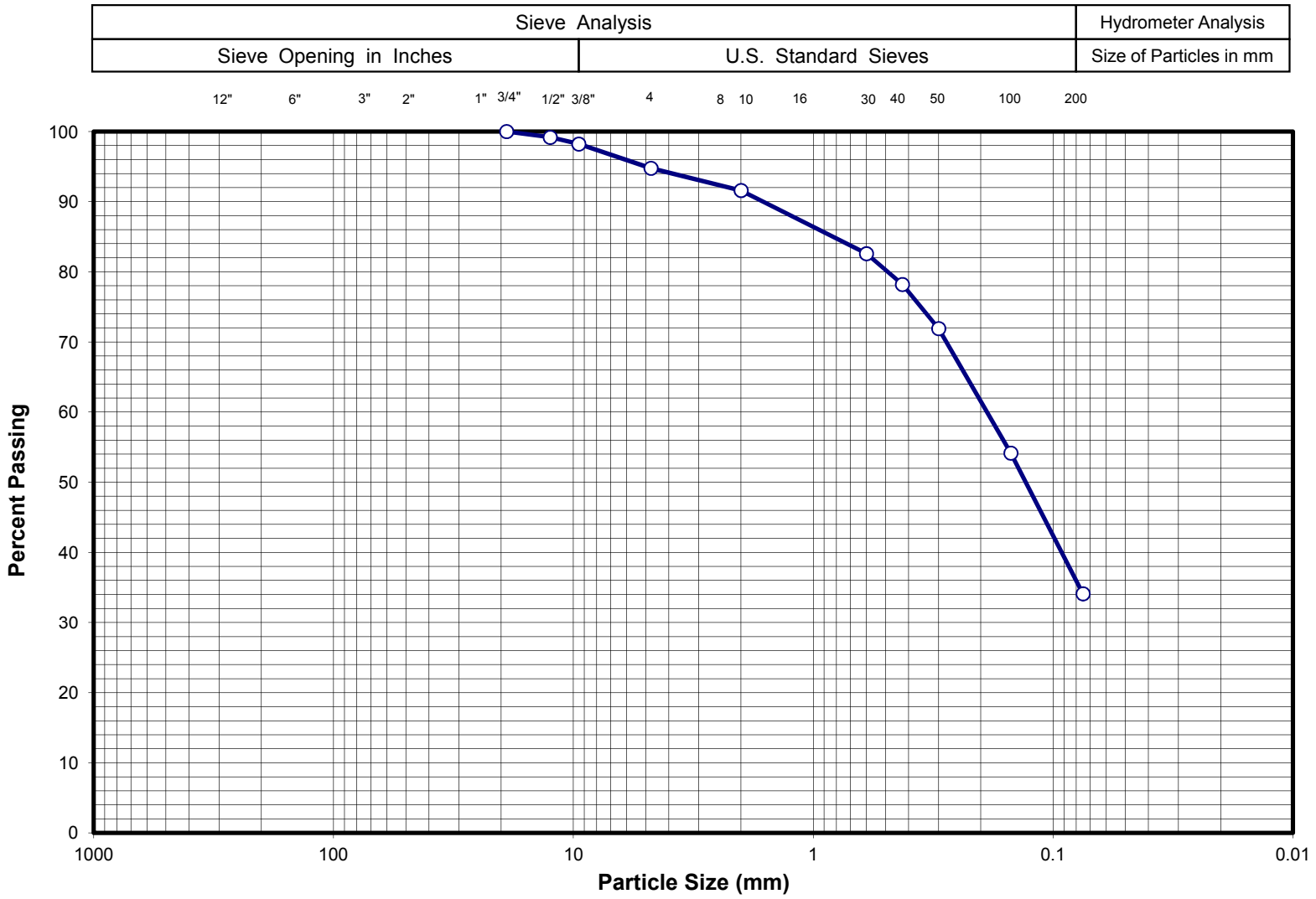
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	99
⅜"	98
#4	95
#10	92
#40	78
#200	34

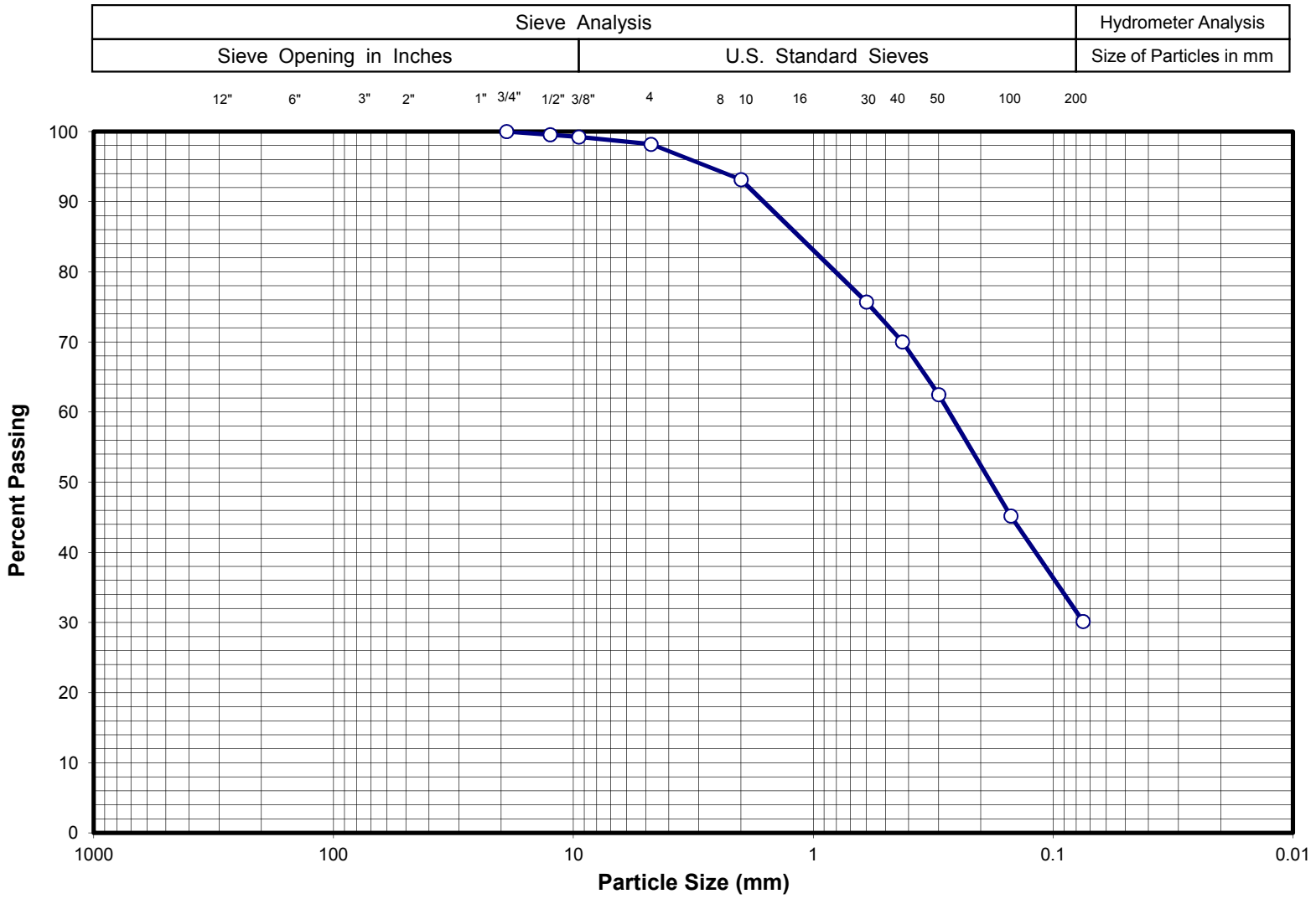
Gravel (%)	5	LL	NV	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	61	PL	NP	Sample ID:	P -6
Fines (%)	34	PI	NP	Sample Depth (ft.):	0-5
Sample Description:	SM / A - 2 - 4 (0)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	100
⅜"	99
#4	98
#10	93
#40	70
#200	30

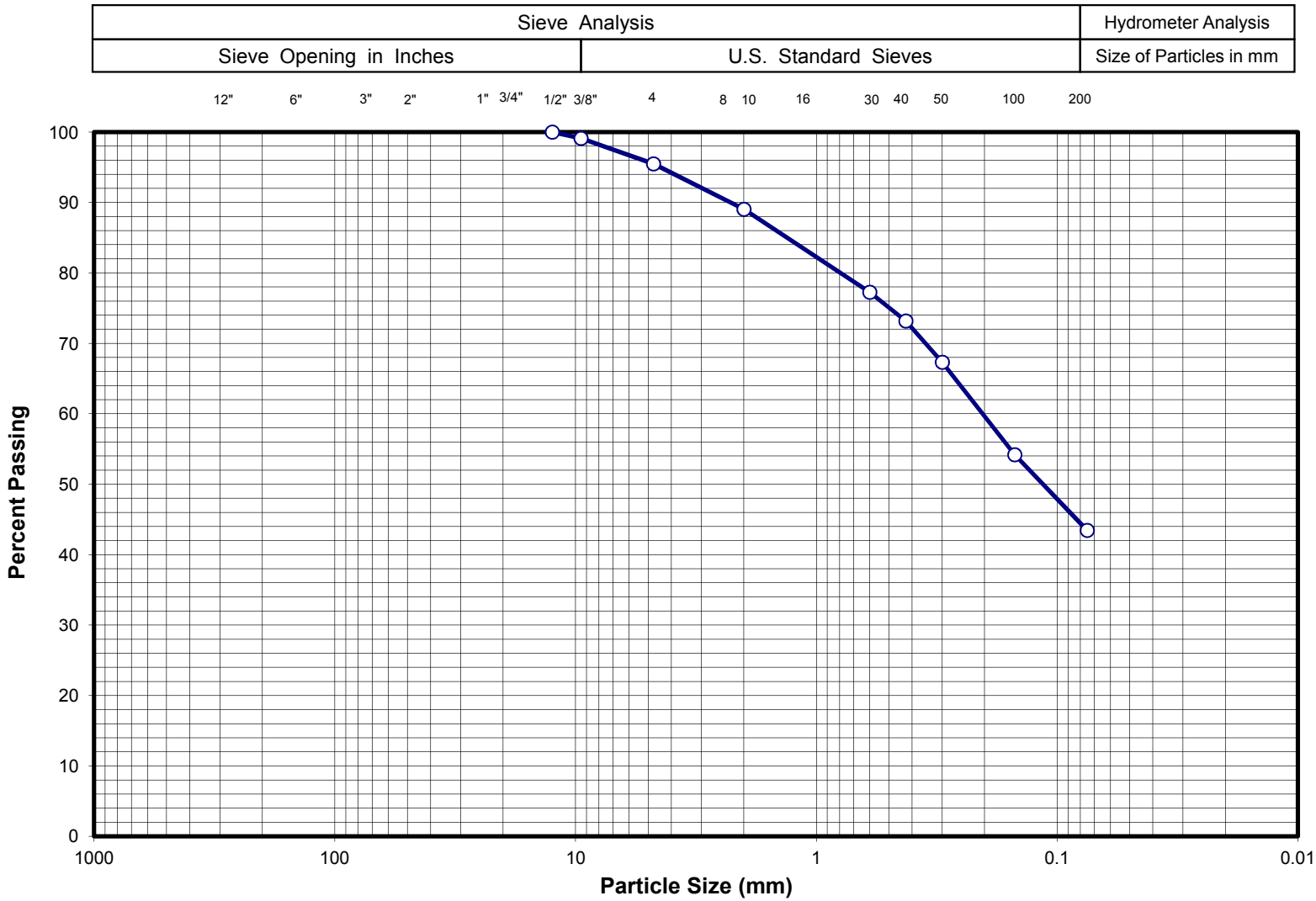
Gravel (%)	2	LL	NV	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	68	PL	NP	Sample ID:	P -7
Fines (%)	30	PI	NP	Sample Depth (ft.):	0-5
Sample Description:	SM / A - 2 - 4 (0)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	100
⅜"	99
#4	95
#10	89
#40	73
#200	43

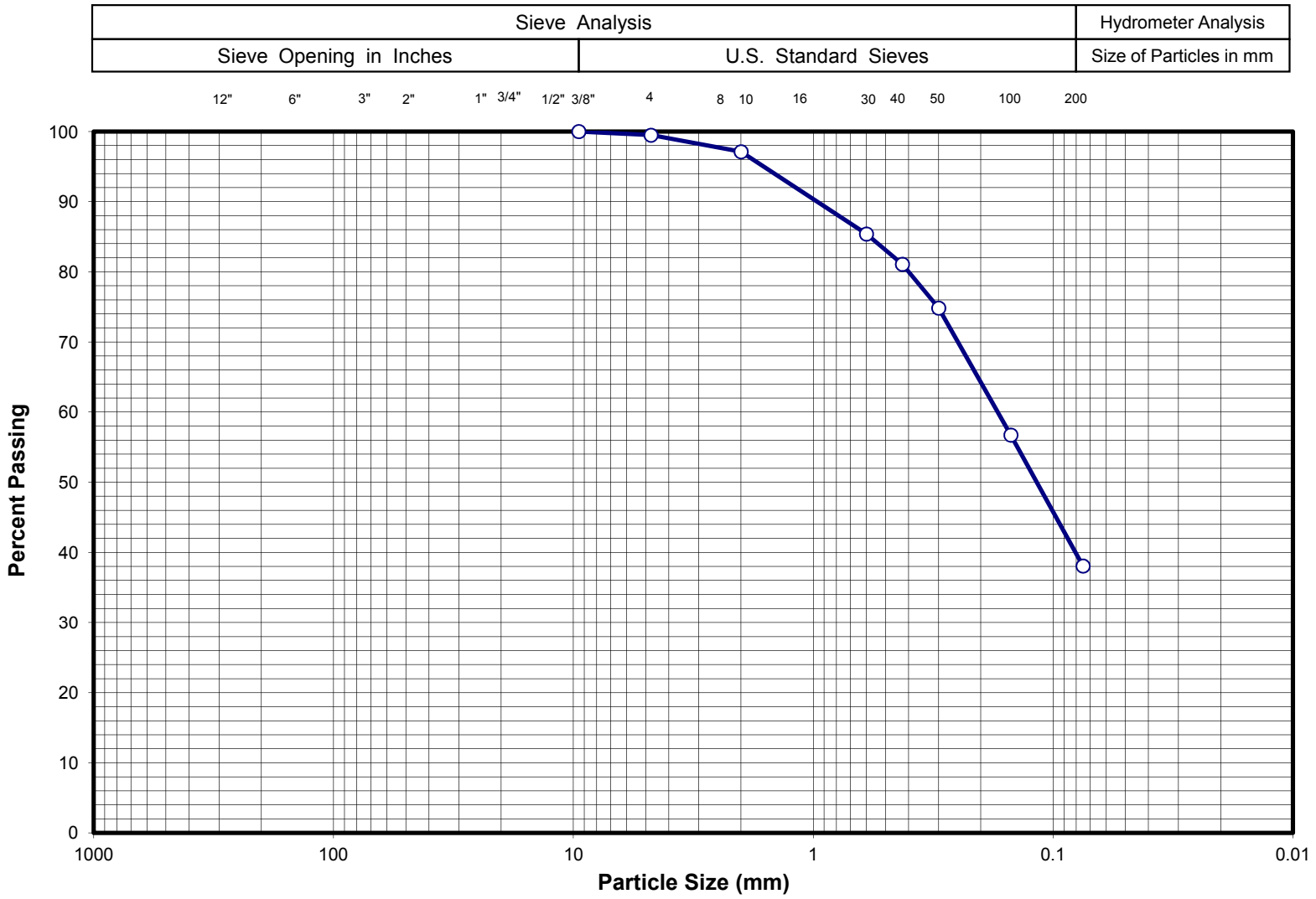
Gravel (%)	5	LL	36	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	52	PL	14	Sample ID:	P -8
Fines (%)	43	PI	22	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 6 (5)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	99
#10	97
#40	81
#200	38

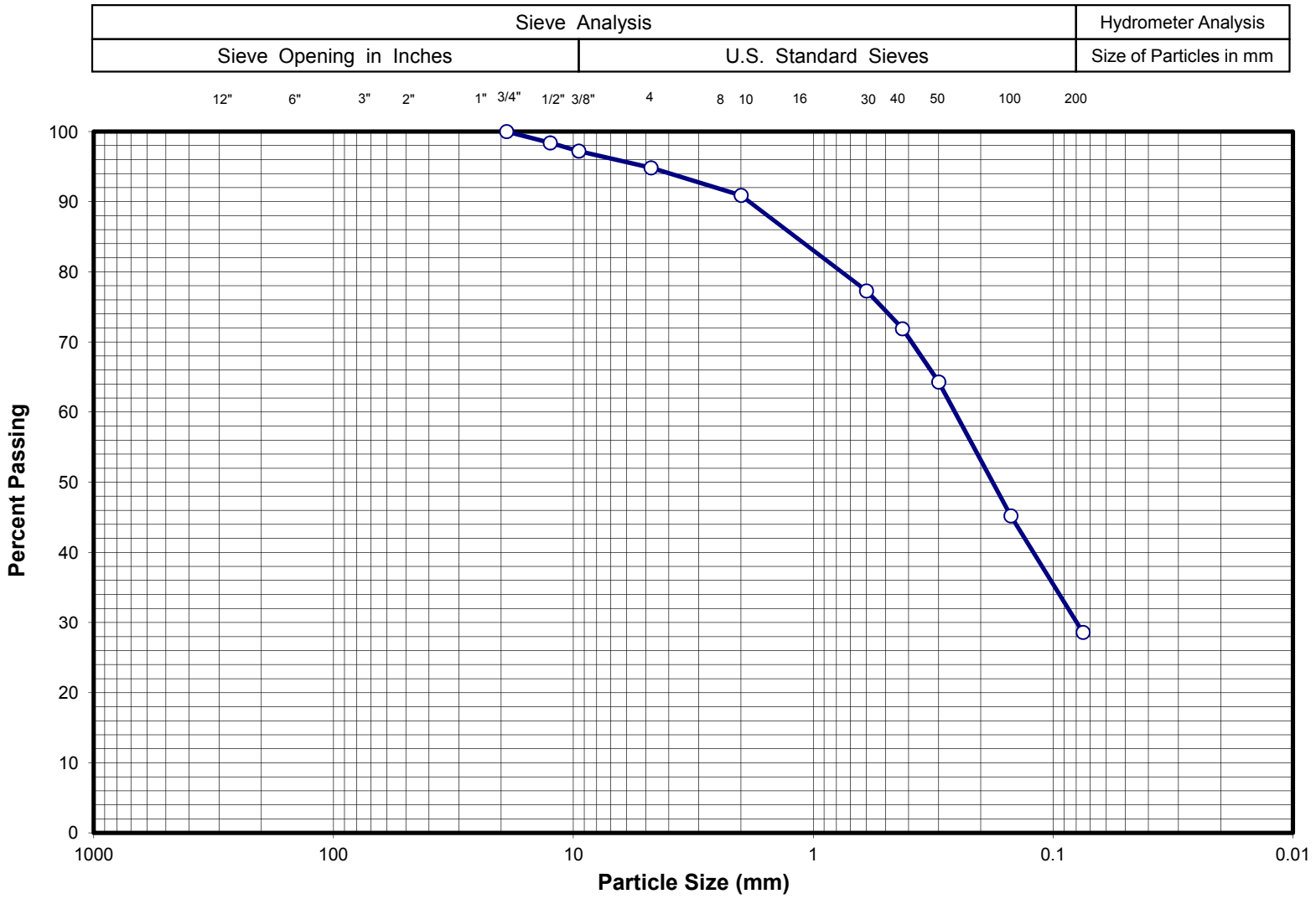
Gravel (%)	1	LL	29	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	61	PL	19	Sample ID:	P -10
Fines (%)	38	PI	10	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 4 (0)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	98
⅜"	97
#4	95
#10	91
#40	72
#200	29

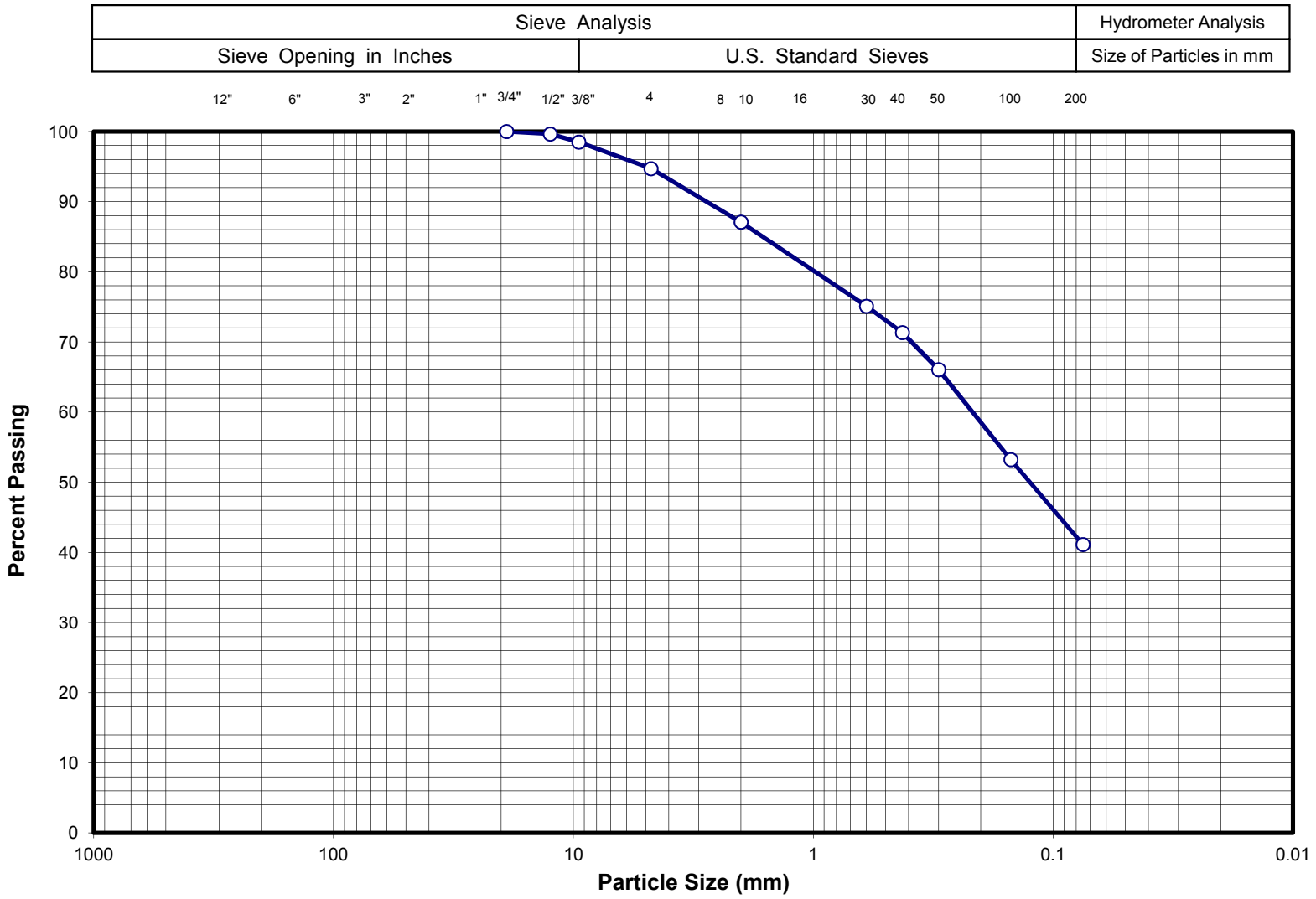
Gravel (%)	5	LL	NV	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	66	PL	NP	Sample ID:	P -12
Fines (%)	29	PI	NP	Sample Depth (ft.):	0-5
Sample Description:	SM / A - 2 - 4 (0)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	100
⅜"	98
#4	95
#10	87
#40	71
#200	41

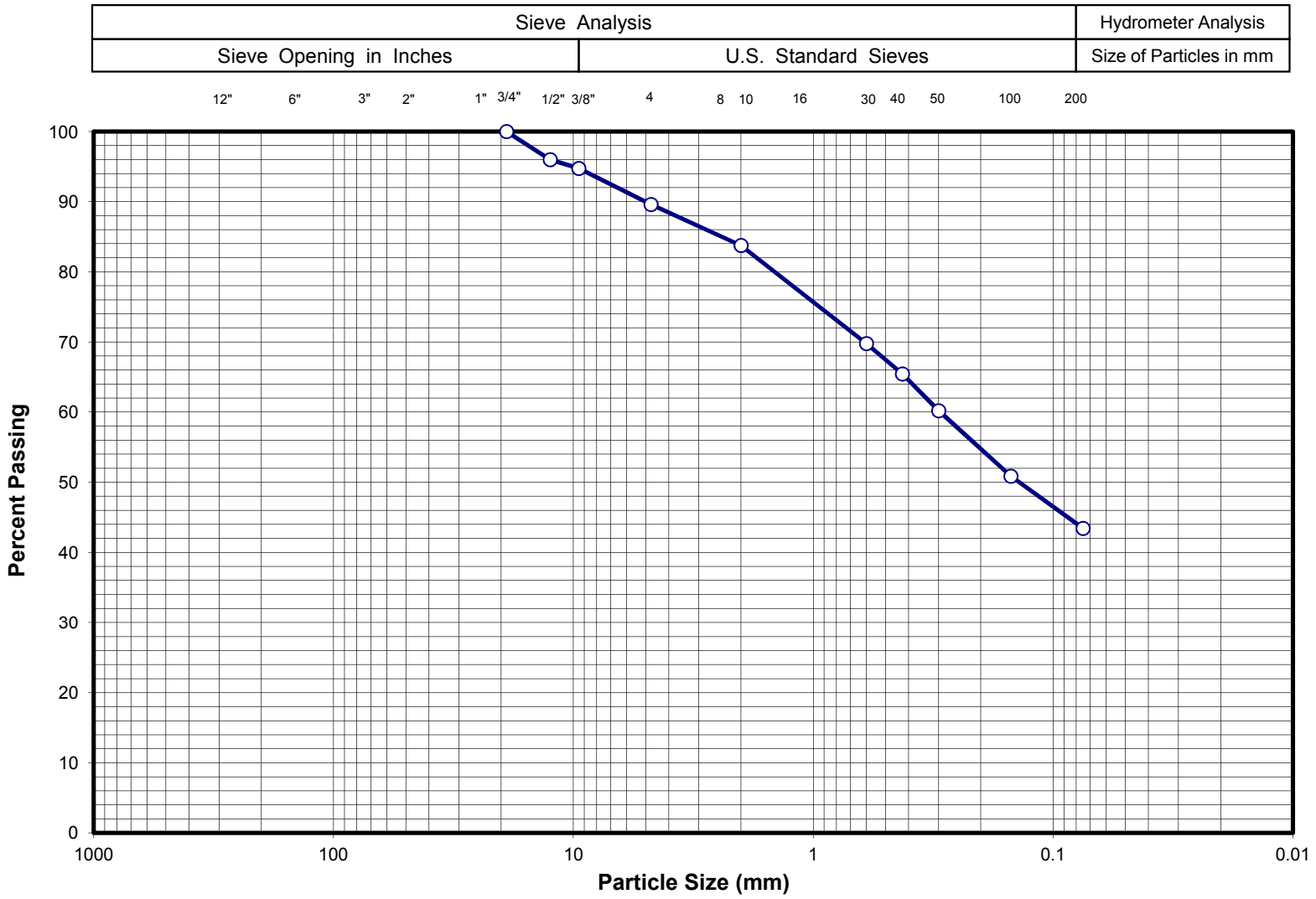
Gravel (%)	5	LL	33	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	54	PL	14	Sample ID:	P -14
Fines (%)	41	PI	19	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 6 (3)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	96
⅜"	95
#4	90
#10	84
#40	65
#200	43

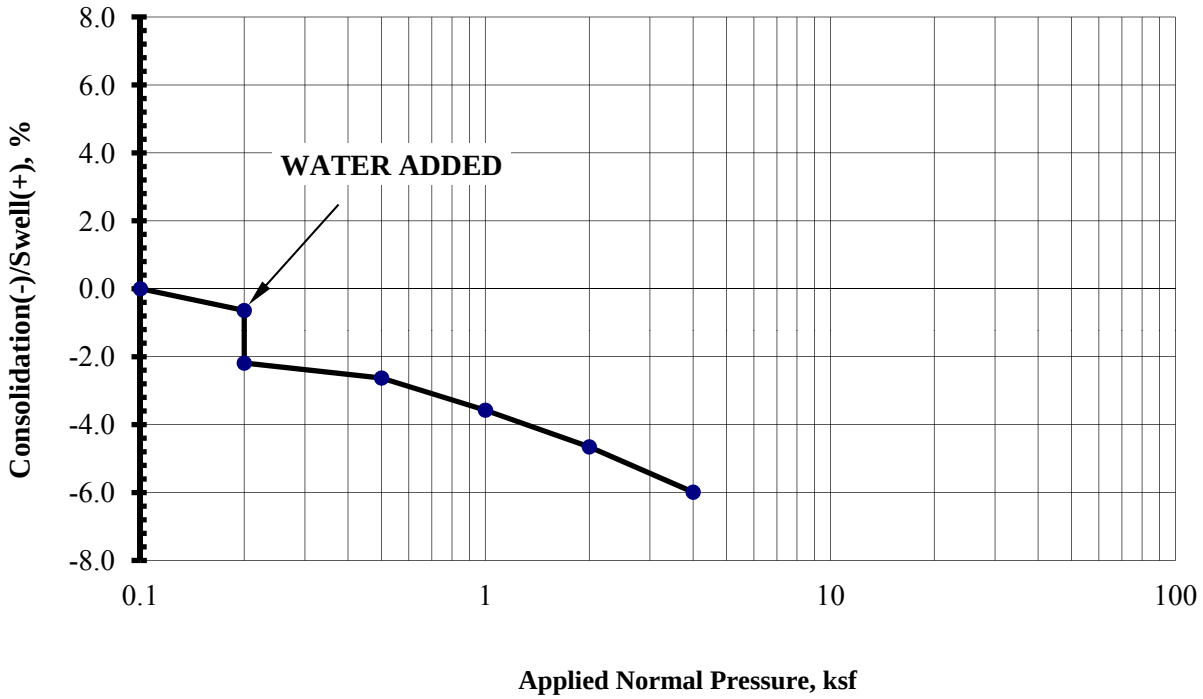
Gravel (%)	10	LL	45	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	47	PL	15	Sample ID:	P -16
Fines (%)	43	PI	30	Sample Depth (ft.):	0-5
Sample Description:	CL / A - 7 - 6 (18)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

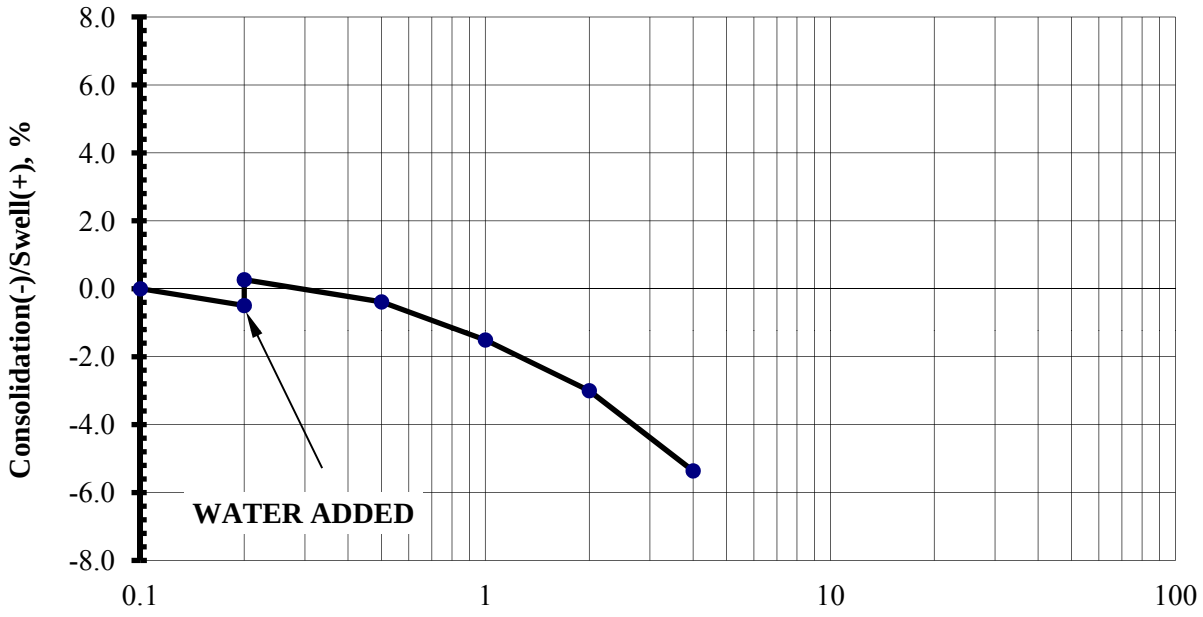
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004

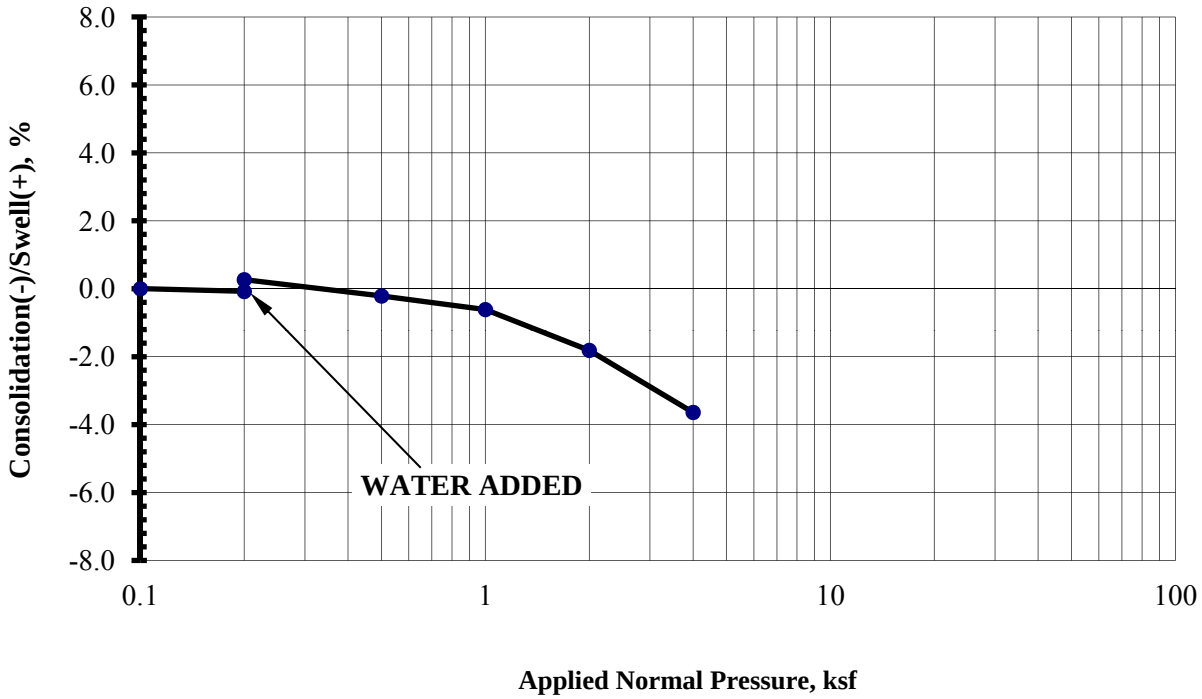


Boring Number		Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH
P-1		2-3	82.4	32.3%	-1.5	High plasticity CLAY	Drawn By: M.A
Job No:	211-117	Project Name:		Federal Blvd Ave to Huron			Checked By: RFL



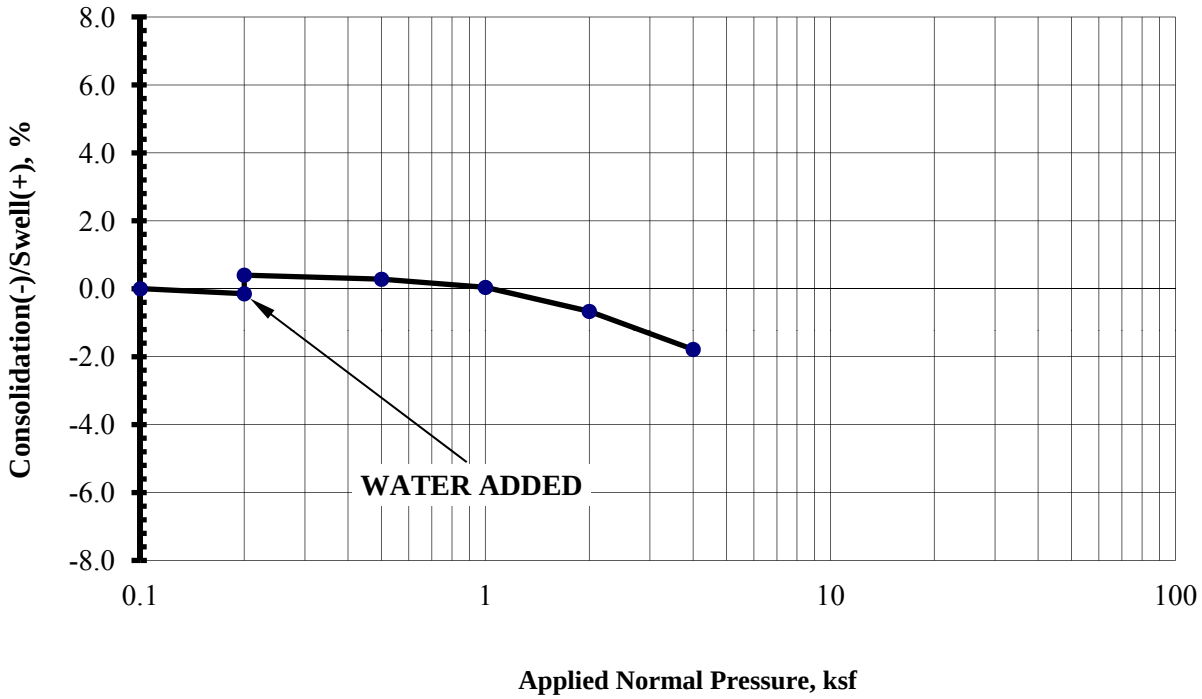
Boring Number		Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH	
P-9		5-6	81.3	31.2%	0.8	CLAY	Drawn By:	M.A
Job No:	211-117	Project Name:		Federal Blvd Ave to Huron			Checked By:	RFL

YEH & ASSOCIATES, INC



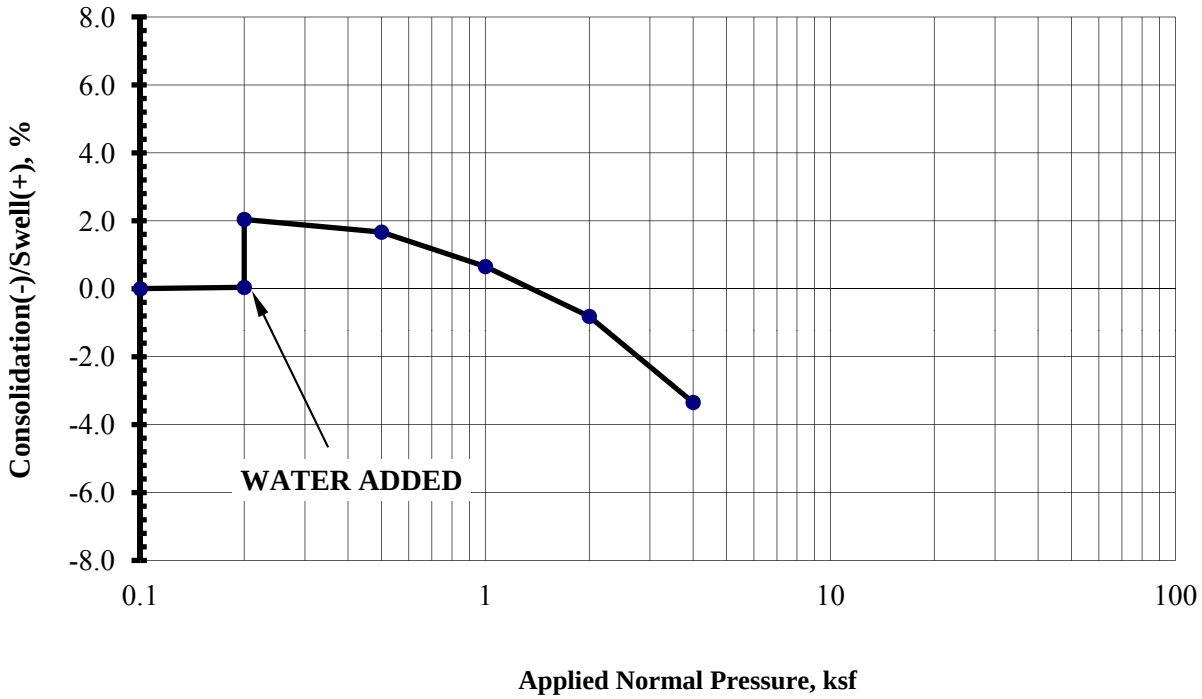
Boring Number		Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH	
P-11		2-3	99.9	21.1%	0.3	CLAY	Drawn By:	M.A
Job No:	211-117	Project Name:		Federal Blvd Ave to Huron			Checked By:	RFL

YEH & ASSOCIATES, INC



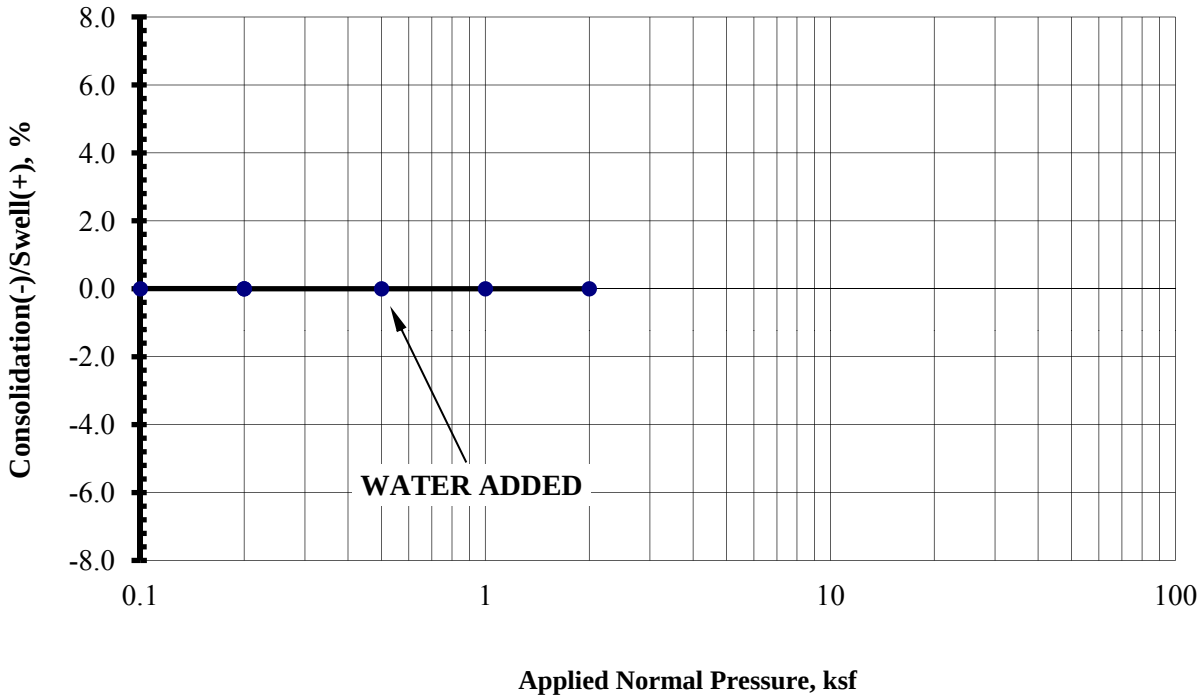
Boring Number		Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH
P-14		1.4-2.4	107.5	15.8%	0.5	clayey SAND	Drawn By: M.A
Job No:	211-117	Project Name:		Federal Blvd Ave to Huron			Checked By: RFL

YEH & ASSOCIATES, INC



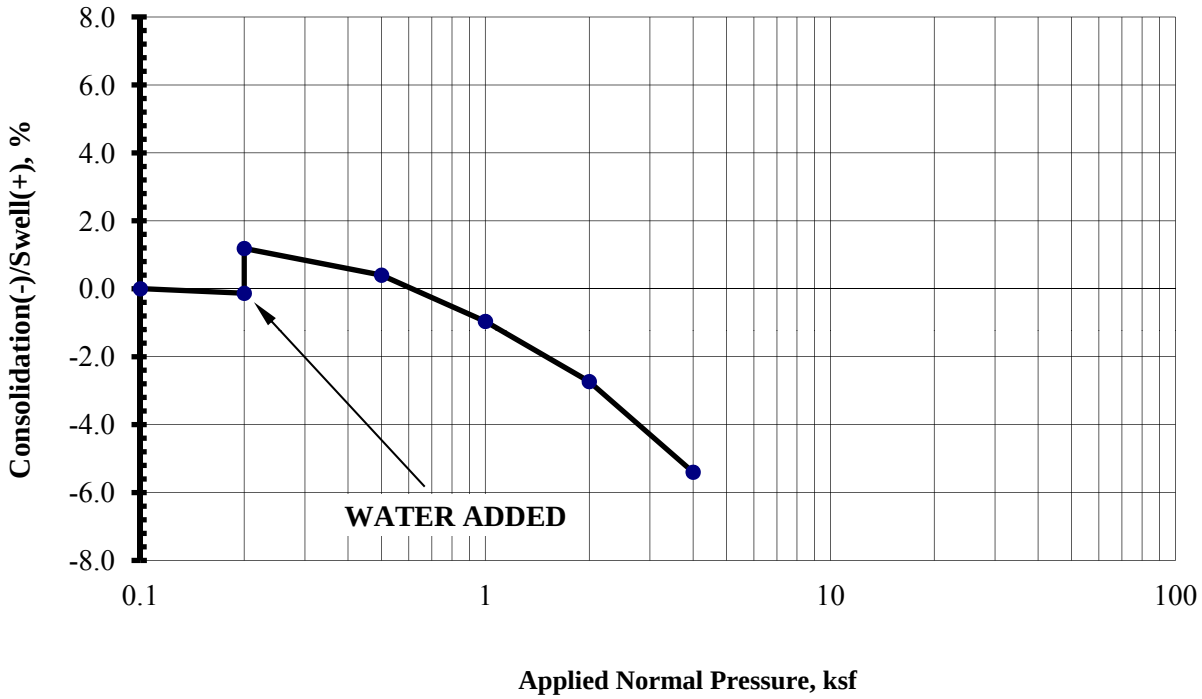
Boring Number		Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH	
P-15		5-6	95.1	23.0%	2.0	CLAY	Drawn By:	M.A
Job No:	211-117	Project Name:		Federal Blvd Ave to Huron			Checked By:	RFL

YEH & ASSOCIATES, INC



Boring Number	Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH
P-16	5-6	98.4	11.6%	0.0	CL	Drawn By: M.A
Job No: 211 - 11	Project Name:		Federal Blvd Ave to Huron			Checked By: RFL

YEH & ASSOCIATES, INC

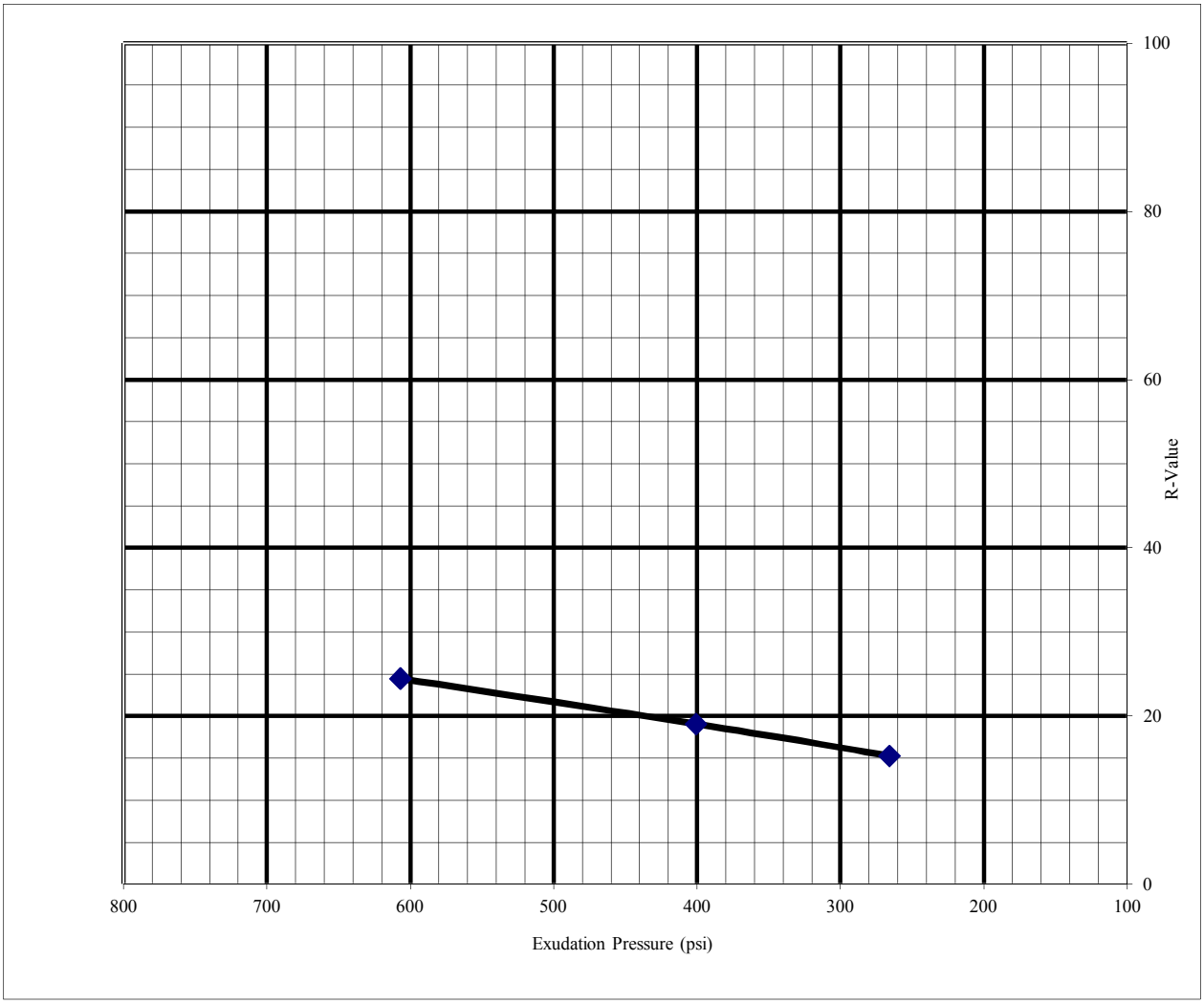


Boring Number		Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH	
P-17		5-6	88.5	30.3%	1.3	high plasticity CLAY	Drawn By:	M.A
Job No:	211-117	Project Name:		Federal Blvd Ave to Huron			Checked By:	RFL

YEH & ASSOCIATES, INC

YEH AND ASSOCIATES, INC
R-Value Test Report

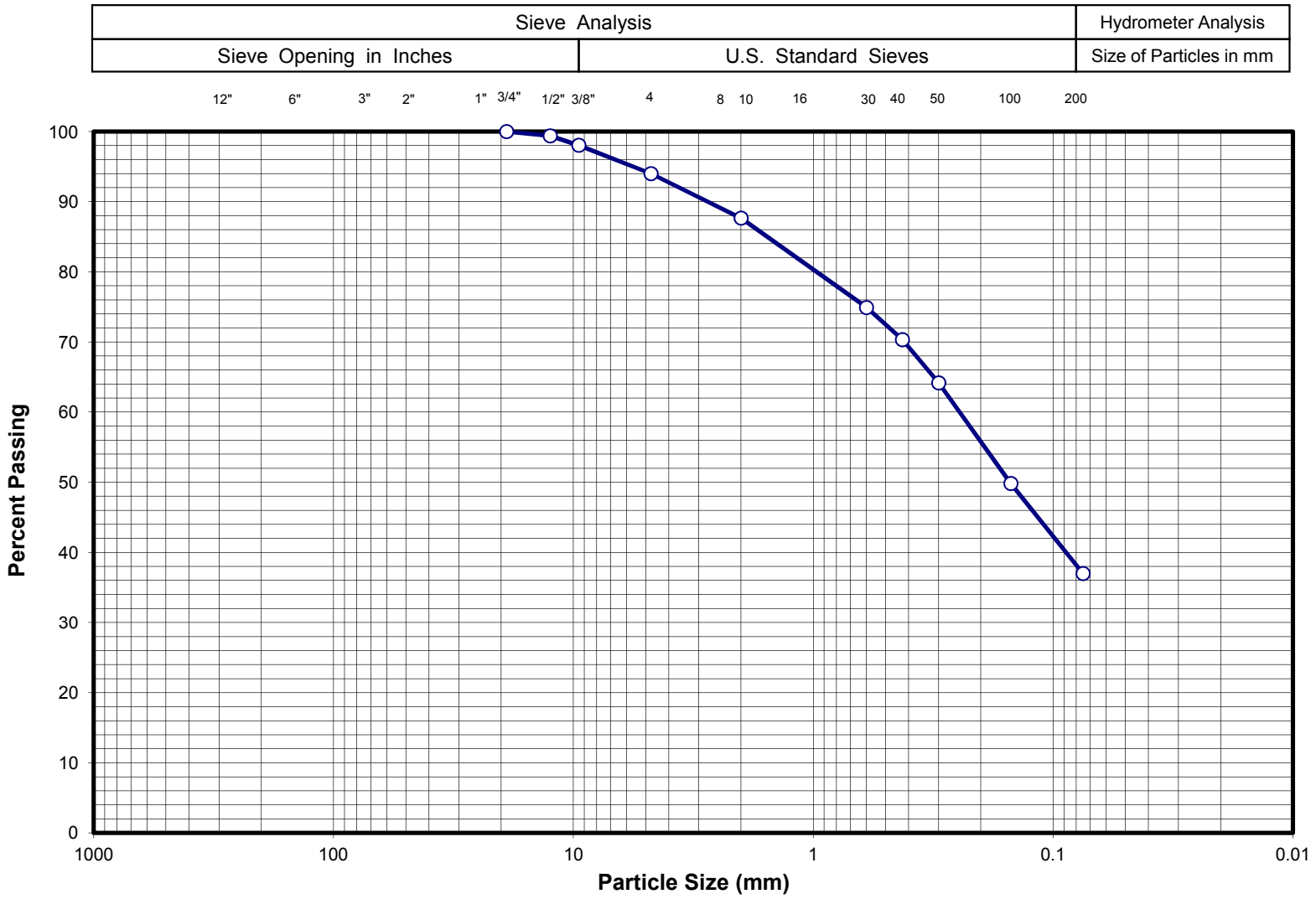
Project Number:211-052 **Project Name:** Lee's Ferry Road
Sample Id: Mix 1 **Depth (ft):**
Soil Description: clayey SAND **Classification:** A-6(2)/ SC
R-Value at 300 psi exudation pressure = **16**



Test No.	Compact. Press. (psi)	Density (pcf)	Moist. (%)	Horizont. Pressure (psi)'@ 160 psi	Sample Height (in).	Exud. Pressure (psi)	R Value	R Value Correct.
1	300	124.5	12	102.3	2.40	607	25	24
2	300	124.1	13	117	2.56	401	17	19
3	300	124.2	14	122	2.56	266	13	15

Tested by: Mustapha Aichiouene **Checked by:** RFL

Rev.2-2/2011



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	99
⅜"	98
#4	94
#10	88
#40	70
#200	37

Gravel (%)	6	LL	31	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	57	PL	15	Sample ID:	Mix-1
Fines (%)	37	PI	16	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 6 (2)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

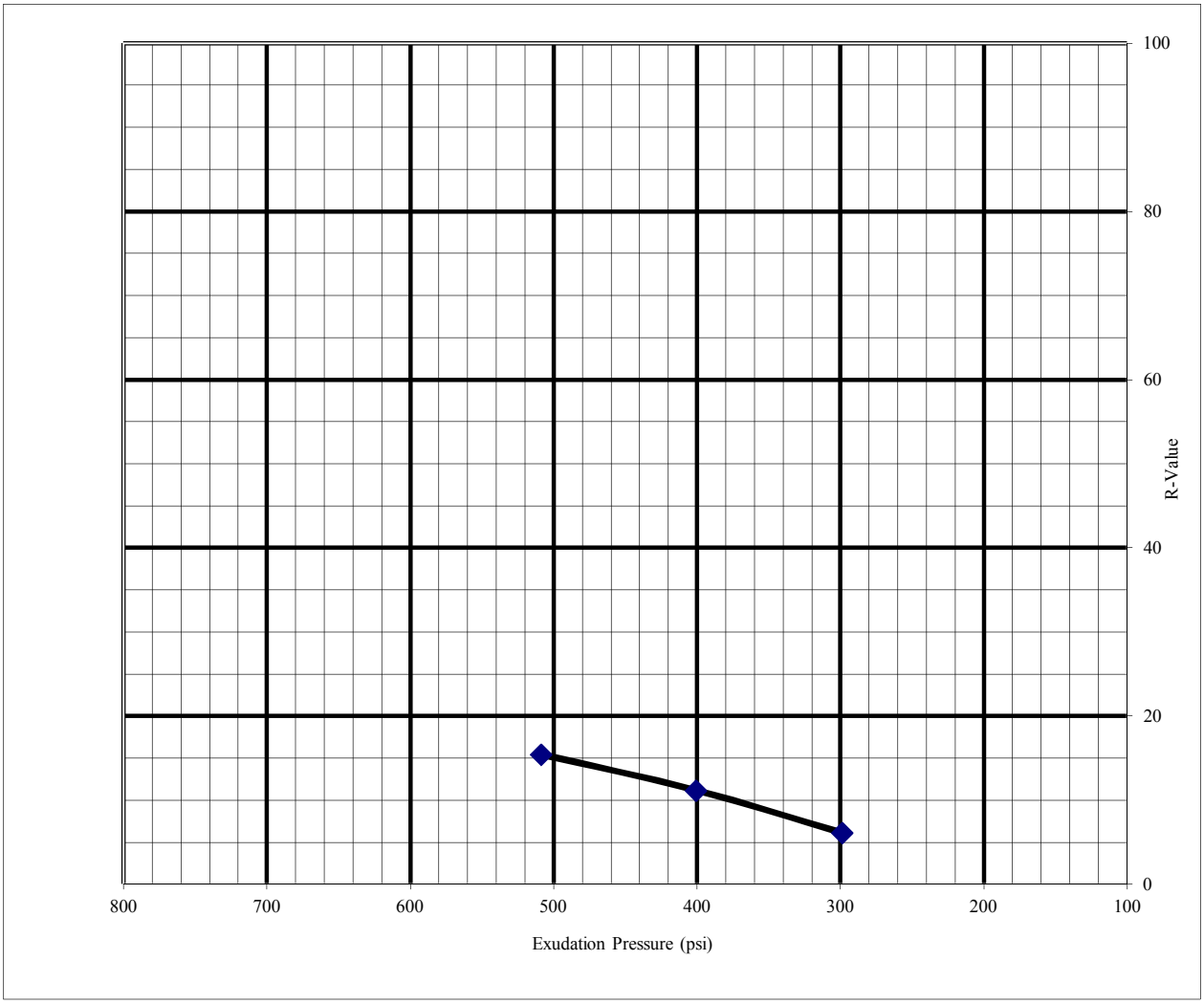
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004

YEH AND ASSOCIATES, INC
R-Value Test Report

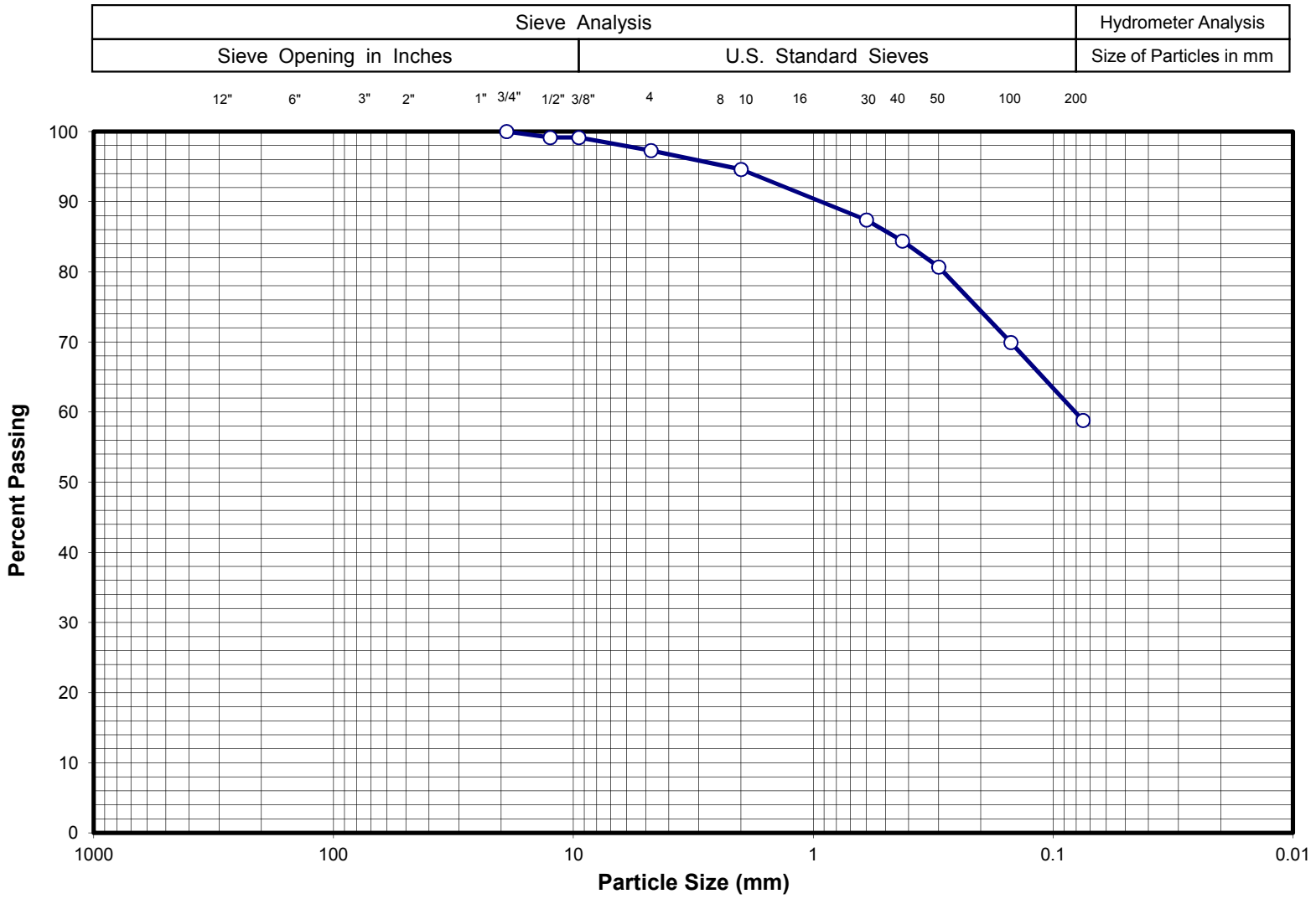
Project Number:211-052 **Project Name:** Lee's Ferry Road
Sample Id:MIX 2 **Depth (ft):** 1-3
Soil Description: sandy CLAY **Classification:** A-7-6(15)/ CL
R-Value at 300 psi exudation pressure = 6



Test No.	Compact. Press. (psi)	Density (pcf)	Moist. (%)	Horizont. Pressure (psi)'@ 160 psi	Sample Height (in).	Exud. Pressure (psi)	R Value	R Value Correct.
1	300	108.1	22	132	2.59	509	13	15
2	300	105.2	24	135	2.61	401	10	11
3	300	105.1	26	145	2.53	299	5	6

Tested by: Mustapha Aichiouene **Checked by:** RFL

Rev.2-2/2011



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	99
⅜"	99
#4	97
#10	95
#40	84
#200	59

Gravel (%)	3	LL	48	Project Name:	Federal Blvd 6th Ave to North
Sand (%)	38	PL	17	Sample ID:	Mix-2
Fines (%)	59	PI	31	Sample Depth (ft.):	0-5
Sample Description:	CL / A - 7 - 6 (15)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

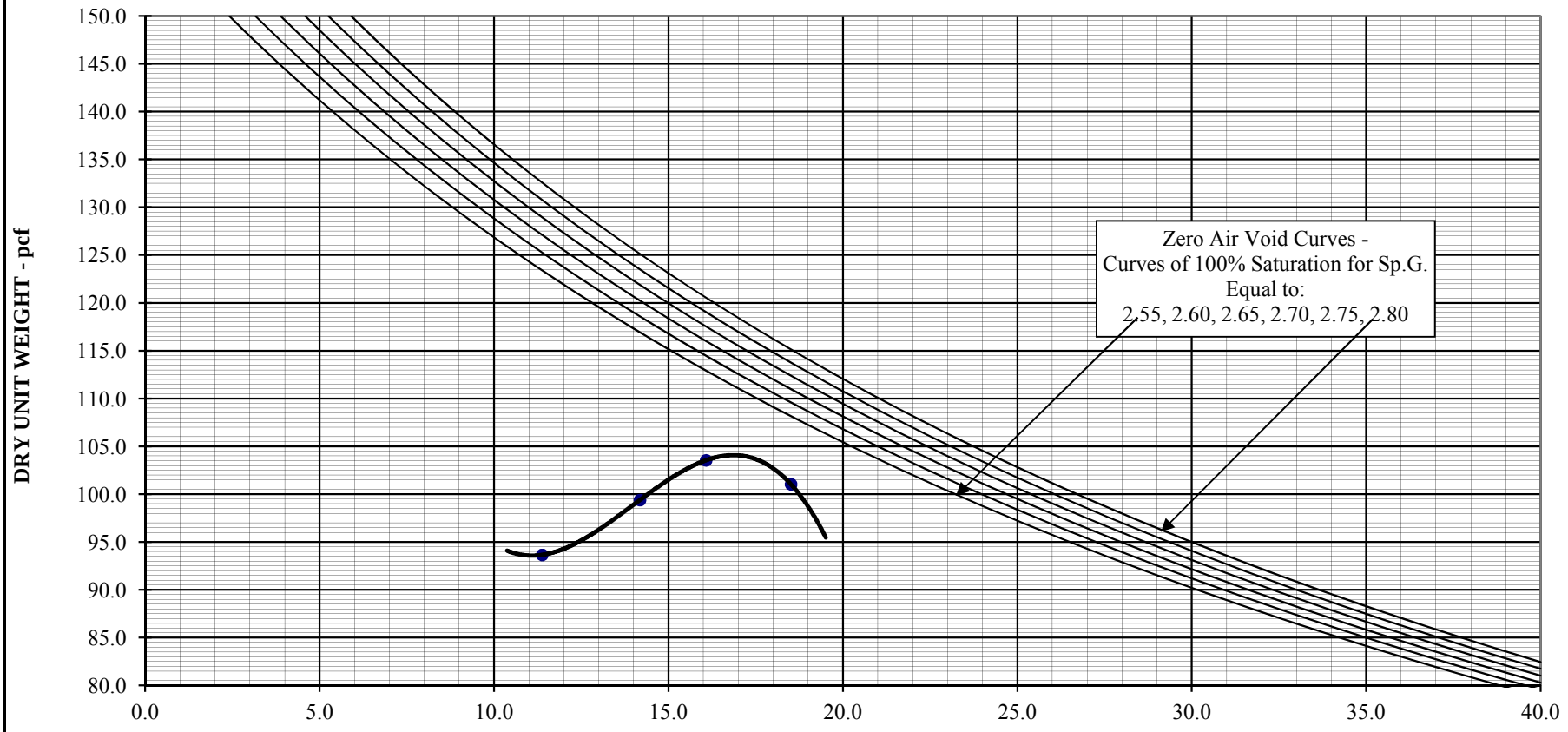
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	RFL	Figure No.:	-
Date:	09/15/11		

Revised 04/27/2004

YEH & ASSOCIATES, INC.

Project No:	211-117	Compaction Effort:	Standard	Compaction Test Procedure:	AASHTO T99 Method A
Project Name:	Federal Blvd 6th Ave to Huron	Stationing	0.00	Proctor No.	# Mix 3
Source Name	0	Sample Location	0		
Sampled On:	09/25/11	Lab. Maximum Dry Density (MDD), pcf:	**104.7**	Rock Corr	**0.0**
Caution: Assumed Rock SpG of 2.60 & 1% Moisture		Lab. Optimum Moisture Content (OMC), %:	**16.9**	Rock Corr	**0.0**



LABORATORY COMPACTION (PROCTOR) GRAPH

Sample ID	LL	PL	PI	- #200 (%)	Soil Description	Classification	Drawn by	Date Sampled	Checked by
# Mix 3	**50**	**17**	**33**	**62**	High Plasticity SANDY clay CLAY	A-7-6 (18) CH	**M.A**	9/25/11	RFL

YEH & ASSOCIATES, INC.

WORKSHEET FOR UNCONFINED COMPRESSIVE STRENGTH TEST

OF COHESIVE SOIL (ASTM D 2166)

Project No: 211 - 117 oject Name: Federal Blvd 6th Ave to Huron
Sampled b: RFL Date Sampled: 10/3/2011 Date Tested: 4-Oct-11
Boring No: Mix-3 Depth (ft): 0 Blow Counts:
Tested by: M.A Checked by: RFL
Soil Description: Claystone Brown-gray, moist, plastic

Sample Data:
Diameter: 1.925 in. Length: 3.941 in. Ratio (limits: 2.0 - 2.5): 2.047
Initial Area of Specimen, Ao: 2.910 sq. in. Rate of Load Application: 0.05 in. / min.

Test Results:

Dial Reading (in.)	Axial Load (lb)	Axial Strain (%)	Corresponding ave. cross-sect'l. area, A (sq. in.)	Comp. Stress (psf)	Dial Readin (in.)	Axial Load (lb)	Axial Strain (%)	Corresponding ave. cross-sect'l. area, A (sq. in.)	Comp. Stress (psf)
0.010					0.100				
0.020					0.110				
0.030					0.120				
0.040					0.130				
0.050					0.140				
0.060					0.150				
0.070					0.160				
0.080					0.170				
0.090					0.180				

Peak Load 55 lb

Unconfined Compressive Strength (q_u) = **2721** psf

FORMULA:

Axial Strain (AS) = Dial Rdg., in / L
Corresponding ave. cross-sectional area (A), sq.in. :
= Ao / 1 - AS
Compressive Stress, psf = (Axial Load / A)*144

Sketch of test specimen at failure:

REMINDER: Do not test if specimen height is below the L/D Ratio limits. Otherwise, inform the Engineer.

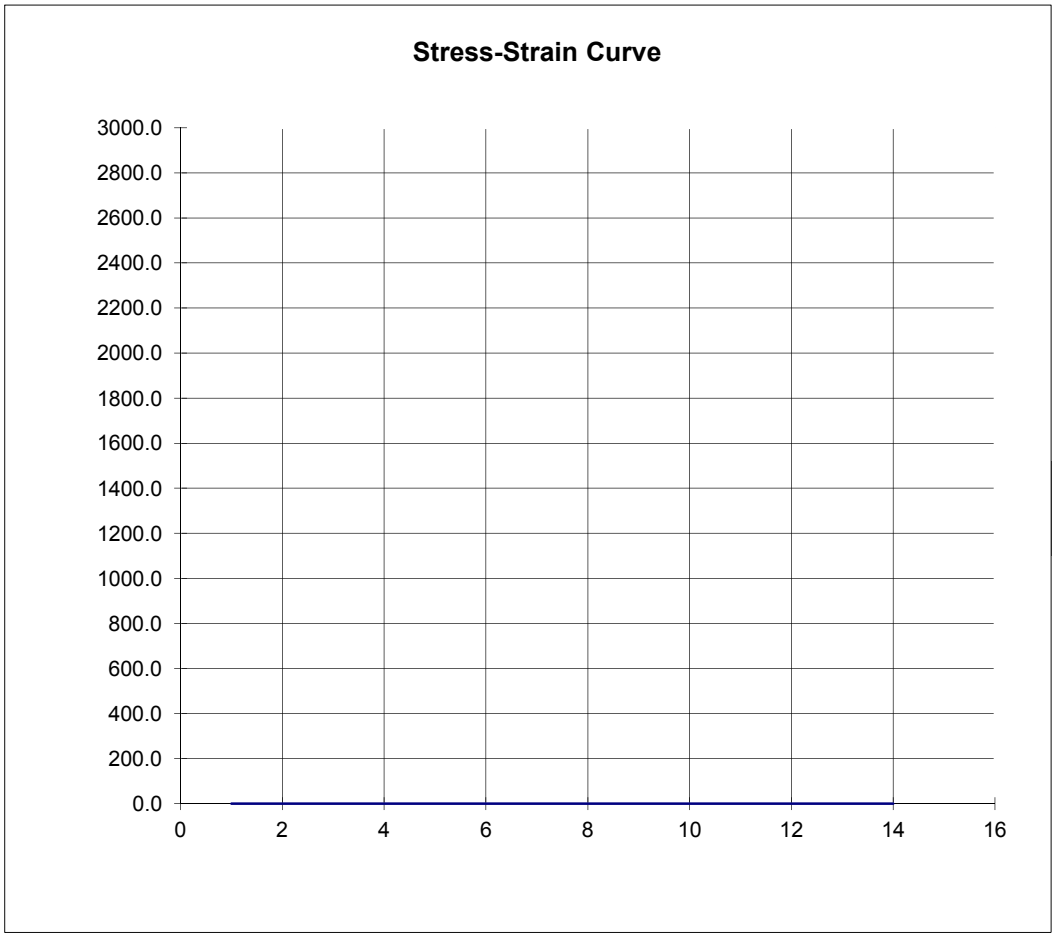
REMARKS:

YEH & ASSOCIATES, INC.

STRESS-STRAIN CURVE
OF COHESIVE SOIL (ASTM D 2166)

Project No	211 - 117	oject Name:	Federal Blvd 6th Ave to Huron		
Sampled b	RFL	Date Sampled:	10/3/2011	Date Tested:	4-Oct-11
Boring No	Mix-3	Depth (ft):	0	Blow Counts:	
Tested by	M.A	Checked by:	RFL		
Soil Description:	Claystone Brown-gray, moist, plastic				

Axial Stra (%)	Axial Stress (psf)



Unconfined Compressive Strength (q_u) = **2412** psf

Natural Moisture:

NaturalDensity: ####### pcf

Average Diameter (D): 1.925 inches

Average High (L): 3.941 inches

L/D Ritio: 2.05

Colorado Analytical Laboratories, Inc.

Analytical Results

TASK NO: 110915028

Report To: Mustafa Aichiouene
Company: Yeh & Associates, Inc.
5700 E. Evans Ave
Denver CO 80222

Bill To: Mustafa Aichiouene
Company: Yeh & Associates, Inc.
5700 E. Evans Ave
Denver CO 80222

Task No.: 110915028
Client PO:
Client Project: Federal Blvd 211-117

Date Received: 9/15/11
Date Reported: 9/22/11
Matrix: Soil - Geotech

Customer Sample ID P-2 @ 1.3-5 Ft.
Sample Date/Time:
Lab Number: 110915028-01

Test	Result	Method
Chloride - Water Soluble	0.2039 %	AASHTO T291-91
pH	8.5 units	AASHTO T289-91
Resistivity	326 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.010 %	AASHTO T290-91

Customer Sample ID P-10 @ 0.6-5 Ft.
Sample Date/Time:
Lab Number: 110915028-02

Test	Result	Method
Chloride - Water Soluble	0.0684 %	AASHTO T291-91
pH	8.3 units	AASHTO T289-91
Resistivity	533 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.004 %	AASHTO T290-91

Customer Sample ID P-12 @ 1.3-5 Ft
Sample Date/Time:
Lab Number: 110915028-03

Test	Result	Method
Chloride - Water Soluble	0.1829 %	AASHTO T291-91
pH	8.2 units	AASHTO T289-91
Resistivity	294 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.004 %	AASHTO T290-91

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.
ASTM - American Society for Testing and Materials.
ASA - American Society of Agronomy.
DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.

DATA APPROVED FOR RELEASE BY

240 South Main Street / Brighton, CO 80601-0507 / 303-659-2313
Mailing Address: P.O. Box 507 / Brighton, CO 80601-0507 / Fax: 303-659-2315

Colorado Analytical Laboratories, Inc.

Analytical Results

TASK NO: 110915028

Report To: Mustafa Aichiouene
Company: Yeh & Associates, Inc.

Bill To: Mustafa Aichiouene
Company: Yeh & Associates, Inc.

Task No.: 110915028
Client PO:
Client Project: Federal Blvd 211-117

Date Received: 9/15/11
Date Reported: 9/22/11
Matrix: Soil - Geotech

Customer Sample ID P-15 @ 2.5-5 Ft.
Sample Date/Time:
Lab Number: 110915028-04

Test	Result	Method
Chloride - Water Soluble	0.0385 %	AASHTO T291-91
pH	8.0 units	AASHTO T289-91
Resistivity	439 ohm.cm	AASHTO T288-91
Sulfate - Water Soluble	0.022 %	AASHTO T290-91

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.
ASTM - American Society for Testing and Materials.
ASA - American Society of Agronomy.
DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.

DATA APPROVED FOR RELEASE BY

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Appendix C- Traffic Loading Calculations

Traffic Loading Calculations
2017 Build Year

Based on the traffic counts and the assignment of ESAL Factors for each vehicle class, the Design ESALs for HMA and PCCP Pavement for the 2017 build year would be as follows:

HMA 6,883,280 ESALs
PCCP 10,32,4,920 ESALs

However, the CCD counts did not include any growth information. From the CDOT web page, the 20-Year factor for this section of Federal Boulevard is 1.14. Using the method of averages for 20-year loadings [(Year 1 + Year 20)]/2 to calculate the design ESALs, the design ESALs used should be 20-Year X 1.07 and 30-Year X 1.10.

Following are the design ESALs used for the pavement thickness determination on Federal Boulevard.

20-Year HMA ESALs = 7,365,110 ESALs
30-Year PCCP ESALs = 11,357,412 ESALs

For the intersection of Federal Blvd. and 8th Avenue, the pavement thickness determination the ESALs for the average loading on 8th Avenue and the loading on Federal Boulevard were added together. The design ESALs for the intersection with a 2017 build year are as follows:

20-Year HMA ESALs = 8,461,483 ESALs
30-Year PCCP ESALs = 13,768,087 ESALs

ESALs and Future Traffic Volumes for Highway 088

From RefPoint 0 To RefPoint 1.1

ESAL Calculations are based on the following:
Build Year: 2012
Design Life: 20 years HMA
Number of Lanes: 6

Route	Ref Point	End Ref Point	Length (Miles)	AADT	AADT YR	YR20 Factor	AADT Single Trucks	AADT Comb. Trucks	AADT 2032	AADT Single Trucks 2032	AADT Comb. Trucks 2032	18 KiP ESALs
088A	0.000	0.143	0.162	35,000	2010	1.13	1300	460	40,005	1,486	526	2,180,076
088A	0.143	0.745	0.603	34,000	2010	1.12	1200	480	38,488	1,358	543	2,154,043
088A	0.745	1.090	0.264	36,000	2010	1.14	1200	500	41,544	1,385	577	2,243,867
088A	1.090	1.360	0.361	42,000	2010	1.19	1400	590	50,778	1,693	713	2,707,925
088A	1.360	1.978	0.626	42,000	2010	1.19	1400	590	50,778	1,693	713	2,707,925

If you notice an error, bug or have any questions, Please E-mail us.

Vehicle Class ->	Bike	Cars & Pick-ups	2 axle Long	Busses	2 axle 6 tire	3 axle single	4 axle single	<5 axle double	5 axle double	>6 axle double	<6 axle multiple	6 axle multiple	>6 axle multiple	not classified	Total		
NB Fed S/O 8th - 8/16/11	30	1110	454	29	92	4	0	30	1	2	0	1	1	6898	8652		
NB Fed S/O 8th - 8/17/11	69	2434	1354	127	379	19	1	97	3	2	1	1	0	3756	8243		
NB Fed S/O 8th - 8/18/11	80	2245	1446	115	416	26	1	119	8	5	3	0	0	3968	8432		
NB Fed S/O 8th - 8/19/11	67	2074	1385	116	408	12	1	117	6	7	7	1	2	4191	8394		
NB Fed S/O 8th - 8/20/11	66	2065	1379	83	280	4	0	96	1	3	3	0	0	4775	8755	# classif	
Average =	62.4	1985.6	1203.6	94	315	13	0.6	91.8	3.8	3.8	2.8	0.6	0.6	4717.6	8495.2	3777.6	

The volumes for north bound Federal at this locations are not consistent with the remainder of the traffic counts, and will not be used for calculation of design ESALs

Vehicle Class ->	Bike	Cars & Pick-ups	2 axle Long	Busses	2 axle 6 tire	3 axle single	4 axle single	<5 axle double	5 axle double	>6 axle double	<6 axle multiple	6 axle multiple	>6 axle multiple	not classified	Total			
SB Fed S/O 8th - 8/16/11	144	10248	1430	163	286	69	2	229	42	25	20	13	12	1197	13880			
SB Fed S/O 8th - 8/17/11	114	10202	1400	149	341	69	6	220	49	23	31	12	14	1350	13980			
SB Fed S/O 8th - 8/18/11	143	10344	1472	174	292	77	7	249	51	21	26	15	22	1564	14457			
SB Fed S/O 8th - 8/19/11	145	11240	1518	172	324	70	3	221	46	30	29	8	24	1210	15040			
SB Fed S/O 8th - 8/20/11	132	10513	1459	97	169	48	3	162	28	24	18	10	8	1222	13893	# classif	Lane	
Average =	135.6	10509.4	1455.8	151	282.4	66.6	4.2	216.2	43.2	24.6	24.8	11.6	16	1308.6	14250	12941.4	Corr.	
MGPEC ESAL Factor	0.0005	0.0045	0.29	3.848	0.617	0.29	0.29	3.157	1.788	1.788	2.73	1.788	1.788	0.0182			Factor	
2017 Adjusted Avg. Volume	142.0	11003.3	1524.2	158.1	295.7	69.7	4.4	226.4	45.2	25.8	26.0	12.1	16.8	1370.1	**14920**	**2017 Volume**		
2017 Six Lane - 20-Yr ESALs	155	108438	968034	1332302	399522	44286	2793	1565024	177110	100854	155241	47557	65596	54610	**5021521**	**20-Year HMA W/O growth**		
2017 Six Lane - 30-Yr ESALs	233	162657	1452051	1998454	599283	66428	4189	2347536	265664	151281	232861	71336	98394	81914	**7532282**	**30-Year PCCP W/O growth**		
~~Six Lane - 20-Yr ESALs~~	~~148~~	~~103570~~	~~924579~~	~~1272495~~	~~381587~~	~~42298~~	~~2667~~	~~1494770~~	~~169159~~	~~96327~~	~~148272~~	~~45422~~	~~62652~~	~~52158~~	**~~2012 HMA ESALs =~~**	**~~4796104~~**	**~~HMA Design ESALs~~**	
~~Six Lane - 30-Yr ESALs~~	~~223~~	~~155355~~	~~1386868~~	~~1908743~~	~~572381~~	~~63446~~	~~4001~~	~~2242155~~	~~253739~~	~~144490~~	~~222408~~	~~68134~~	~~93977~~	~~78237~~	**~~2012 PCCP ESALs =~~**	**~~7194157~~**	**~~PCC Design ESALs~~**	

Six Lane Correction Factor = 0.3

Vehicle Class ->	Bike	Cars & Pick-ups	2 axle Long	Busses	2 axle 6 tire	3 axle single	4 axle single	<5 axle double	5 axle double	>6 axle double	<6 axle multiple	6 axle multiple	>6 axle multiple	not classified	Total		
NB Fed N/O 10th -8/16/11	**37**	**7138**	**2314**	**195**	**559**	**43**	**0**	**276**	**14**	**27**	**26**	**5**	**12**	**3079**	13725		
NB Fed N/O 10th -8/17/11	42	5848	2489	225	709	46	1	273	23	17	22	2	10	3992	13699		
NB Fed N/O 10th -8/18/11	47	6012	2270	236	642	42	2	230	23	17	26	1	10	4323	13881		
NB Fed N/O 10th -8/19/11	57	7691	2756	254	695	41	0	335	30	30	32	9	7	2956	14893		
NB Fed N/O 10th -8/20/11	39	5250	2281	187	457	15	0	167	5	9	14	0	6	5277	13707	# classif	
Average =	44.4	6387.8	2422	219.4	612.4	37.4	0.6	256.2	19	20	24	3.4	9	3925.4	13981	10055.6	
MGPEC ESAL Factor	0.0005	0.0045	0.29	3.848	0.617	0.29	0.29	3.157	1.788	1.788	2.73	1.788	1.788	0.0182			
2017 Adjusted Avg. Volume	46.5	6688.0	2535.8	229.7	641.2	39.2	0.6	268.2	19.9	20.9	25.1	3.6	9.4	4109.9	**14638**	**2017 Volume**	
2017 Six Lane - 20-Yr ESALs	51	65911	1610508	1935809	866385	24869	399	1854575	77895	81995	150233	13939	36898	163812	**6883280**	**20-Year HMA W/O growth**	
2017 Six Lane - 30-Yr ESALs	76	98866	2415762	2903713	1299578	37304	598	2781863	116843	122993	225349	20909	55347	245718	**10324920**	**30-Year PCCP W/O growth**	
~~Six Lane - 20-Yr ESALs~~	~~49~~	~~62952~~	~~1538212~~	~~1848910~~	~~827493~~	~~23753~~	~~381~~	~~1771323~~	~~74399~~	~~78314~~	~~143489~~	~~13313~~	~~35241~~	~~156459~~	**~~2012 HMA ESALs =~~**	**~~6574288~~**	**~~HMA DesignESALs~~**	
~~Six Lane - 30-Yr ESALs~~	~~73~~	~~94428~~	~~2307318~~	~~2773365~~	~~1241240~~	~~35629~~	~~572~~	~~2656985~~	~~111598~~	~~117472~~	~~215233~~	~~19970~~	~~52862~~	~~234688~~	**~~2012 PCCP ESALs =~~**	**~~9861433~~**	**~~PCC DesignESALs~~**	

Six Lane Correction Factor = 0.3

Vehicle Class ->	Bike	Cars & Pick-ups	2 axle Long	Busses	2 axle 6 tire	3 axle single	4 axle single	<5 axle double	5 axle double	>6 axle double	<6 axle multiple	6 axle multiple	>6 axle multiple	not classified	Total	
SB Fed N/O 10th -8/16/11	122	7082	2240	178	585	65	4	280	36	26	26	11	13	1518	12186	
SB Fed N/O 10th -8/17/11	122	7318	2277	160	589	81	1	296	31	29	27	7	13	1656	12607	
SB Fed N/O 10th -8/18/11	151	7388	2251	160	573	85	2	279	45	30	40	7	10	1902	12923	
SB Fed N/O 10th -8/19/11	134	7533	2266	170	529	74	2	283	50	33	23	9	12	1982	13100	
SB Fed N/O 10th -8/20/11	107	7534	2654	117	497	35	3	253	20	37	15	5	10	1274	12561	# classif
Average =	127.2	7371	2337.6	157	554.6	68	2.4	278.2	36.4	31	26.2	7.8	11.6	1666.4	12675.4	11009
MGPEC ESAL Factor	0.0005	0.0045	0.29	3.848	0.617	0.29	0.29	3.157	1.788	1.788	2.73	1.788	1.788	0.0182		
2017 Adjusted Avg. Volume	133.2	7717.4	2447.5	164.4	580.7	71.2	2.5	291.3	38.1	32.5	27.4	8.2	12.1	1744.7	**13271**	**2017 Volume**
2017 Six Lane - 20-Yr ESALs	146	76055	1554386	1385242	784614	45217	1596	2013829	149231	127093	164004	31978	47557	69541	**6450488**	**20-Year HMA W/O growth**
2017 Six Lane - 30-Yr ESALs	219	114083	2331580	2077862	1176920	67825	2394	3020743	223847	190639	246006	47967	71336	104312	**9675732**	**30-Year PCCP W/O growth**
~~Six Lane - 20-Yr ESALs~~	~~139~~	~~72641~~	~~1484610~~	~~1323058~~	~~749392~~	~~43187~~	~~1524~~	~~1923428~~	~~142532~~	~~121387~~	~~156642~~	~~30543~~	~~45422~~	~~66419~~	**~~2012 HMA ESALs =~~**	**~~6160925~~**	**~~HMA DesignESALs~~**
~~Six Lane - 30-Yr ESALs~~	~~209~~	~~108962~~	~~2226915~~	~~1984587~~	~~1124088~~	~~64780~~	~~2286~~	~~2885141~~	~~213798~~	~~182081~~	~~234963~~	~~45814~~	~~68134~~	~~99629~~	**~~2012 PCCP ESALs =~~**	**~~9241387~~**	**~~PCC DesignESALs~~**

Six Lane Correction Factor = 0.3

The CDOT web page showed a 20-Year factor of 1.14 for 2013 for this section of Federal Boulevard. This growth factor will cause an increase in the 20-Year ESALs of 7% and an increase in the 30-Year ESALs of 10%.

The resultng design ESALs based on highest section of 2017 volumes were used or pavement designs.

			Growth Factor		
20-Yr HMA Design ESALS =	6883280	ESALs X	1.07	=	**7365110 20-Year Design ESALs for HMA**
30-Yr PCCP Design ESALS =	10324920	ESALs X	1.1	=	**11357412 30-Year Design ESALs for PCCP**

Federal Boulevard, 8th +A1:AA104Avenue to Lakewood Gulch 9/15/2016 211-117 211-117 3/3

Calculation of Average Weighting Factor for Unclassified Vehicles

SB Fed S/O 8th - 8/20/11	135.6	10509.4	1455.8	151	282.4	66.6	4.2	216.2	43.2	24.6	24.8	11.6	16	1308.6		14250	12941.4
	1.05%	81.21%	11.25%	1.17%	2.18%	0.51%	0.03%	1.67%	0.33%	0.19%	0.19%	0.09%	0.12%				100.00%
ESAL Factor	0.0005	0.0045	0.29	3.848	0.617	0.29	0.29	3.157	1.788	1.788	2.73	1.788	1.788				
	5.24E-06	0.003654	0.032623	0.044898	0.013464	0.001492	9.41E-05	0.052741	0.005969	0.003399	0.005232	0.001603	0.002211		0.012876	Wt "Avg. ESAL factor	
NB Fed N/O 10th -8/20/11	44.4	6387.8	2422	219.4	612.4	37.4	0.6	256.2	19	20	24	3.4	9	3925.4		13981	10055.6
	0.44%	63.52%	24.09%	2.18%	6.09%	0.37%	0.01%	2.55%	0.19%	0.20%	0.24%	0.03%	0.09%				100.00%
ESAL Factor	0.0005	0.0045	0.29	3.848	0.617	0.29	0.29	3.157	1.788	1.788	2.73	1.788	1.788				
	2.21E-06	0.002859	0.06985	0.083958	0.037576	0.001079	1.73E-05	0.080435	0.003378	0.003556	0.006516	0.000605	0.0016		0.022418	Wt "Avg. ESAL factor	
SB Fed N/O 10th -8/20/11	127.2	7371	2337.6	157	554.6	68	2.4	278.2	36.4	31	26.2	7.8	11.6	1666.4		12675.4	11009
	1.16%	66.95%	21.23%	1.43%	5.04%	0.62%	0.02%	2.53%	0.33%	0.28%	0.24%	0.07%	0.11%				100.00%
ESAL Factor	0.0005	0.0045	0.29	3.848	0.617	0.29	0.29	3.157	1.788	1.788	2.73	1.788	1.788				
	5.78E-06	0.003013	0.061577	0.054877	0.031083	0.001791	6.32E-05	0.079778	0.005912	0.005035	0.006497	0.001267	0.001884		0.019445	Wt "Avg. ESAL factor	

Value Used = 0.018246 Wt "Avg. ESAL factor for unclassified vehicles

8th Avenue ESAL Calcs (High) **Federal Blvd. 6th Ave to West Howard Place** 4-lane 2017 traffic

Future Traffic Volume Calculations

Given: Volumes developed from 2009 Counts

Volumes:	E/O Fed.	W/O Fed.
2012 AADT	**14,500**	9000
2035 AADT	**18,100**	11500
Annual Growth Factor	1.0112	
Distribution:	Uniform	

Year	Volume AADT	**Given 2012 AADT =**			
2012	14500	**14500**	2033	18321	
2013	14662		2034	18526	**Calc.**
2014	14827	**2017**	2035	18734	**20-Year**
2015	14993	**Build**	2036	18943	**AADT =**
2016	15161	**Year**	2037	19156	**19156**
2017	15330	**15330**	2038	19370	
2018	15502		2039	19587	
2019	15676		2040	19806	
2020	15851		2041	20028	
2021	16029		2042	20253	
2022	16208		2043	20479	
2023	16390		2044	20709	**Calc.**
2024	16573		2045	20941	**30-Year**
2025	16759		2046	21175	**AADT =**
2026	16947		2047	21412	**21412**
2027	17137		2048	21652	
2028	17329		2049	21895	
2029	17523	**Given**	2050	22140	
2030	17719	**20-Year**			
2031	17917	**AADT =**			
2032	18118	**18,100**			

Design ESAL Calculations =>

Future 8th Avenue HMA ESAL Calculations

20-Year Design Volume = (2017 Volume + 2037 Volume) / 2 =

Design Vol= **15330** **+** **19156** **=** **17243** **AADT**

20-Year Design ESALs = Design AADT X 365 Days/yr X 20 Years X ESAL Factor

Vehicle Class	HMA ESAL Factor	% of Total	Design AADT	20-Year ESALs
Cars	0.003	96.0%	17243	362516
Single Units	0.249	2.7%	17243	846249
Comb. Units	1.087	1.3%	17243	1778721

Volume ESALs 2987486

4-Lane Correction Factor = 0.45

8th Avenue (High)	20-Year HMA Design ESALs =	1344369	ESALs

Future Mainline PCCP ESAL Calculations

30-Year Design Volume = (2017 Volume + 2047 Volume) / 2 =

Design Vol= **15330** **+** **21412** **=** **18371** **AADT**

30-Year Design ESALs = Design AADT X 365 Days/yr X 30 Years X ESAL Factor

Vehicle Class	PCCP ESAL Factor	% of Total	Design AADT	30-Year ESALs
Cars	0.003	96.0%	18371	579360
Single Units	0.285	2.7%	18371	1547978
Comb. Units	1.692	1.3%	18371	4424864

Volume 79208 ESALs 6552202

4-Lane Correction Factor = 0.45

8th Avenue (High)	30-Year PCCP Design ESALs =	2948491	ESALs

8th Avenue ESAL Calcs (Low) **Federal Blvd. 6th Ave to West Howard Place** 4-lane 2017 traffic

Future Traffic Volume Calculations

Given: Volumes developed from 2009 Counts

Volumes:	E/O Fed.	W/O Fed.
2012 AADT	**14,500**	9000
2035 AADT	**18,100**	11500
Annual Growth Factor	1.0124	
Distribution:	Uniform	

Year	Volume AADT	**Given 2012 AADT =**			
2012	9000	**9000**	2033	11658	
2013	9112		2034	11803	**Calc.**
2014	9225	**2017**	2035	11949	**20-Year**
2015	9339	**Build**	2036	12097	**AADT =**
2016	9455	**Year**	2037	12247	**12247**
2017	9572	**9933**	2038	12399	
2018	9691		2039	12553	
2019	9811		2040	12709	
2020	9933		2041	12866	
2021	10056		2042	13026	
2022	10180		2043	13187	
2023	10307		2044	13351	**Calc.**
2024	10434		2045	13516	**30-Year**
2025	10564		2046	13684	**AADT =**
2026	10695		2047	13854	**13854**
2027	10827		2048	14026	
2028	10962		2049	14199	
2029	11098	**Given**	2050	14376	
2030	11235	**20-Year**			
2031	11375	**AADT =**			
2032	11516	**11,500**			

Design ESAL Calculations =>

Future 8th Avenue HMA ESAL Calculations

20-Year Design Volume = (2017 Volume + 2037 Volume) / 2 =

Design Vol= **9933** + **12247** = **11090** **AADT**

20-Year Design ESALs = Design AADT X 365 Days/yr X 20 Years X ESAL Factor

Vehicle Class	HMA ESAL Factor	% of Total	Design AADT	20-Year ESALs
Cars	0.003	96.0%	11090	233156
Single Units	0.249	2.7%	11090	544273
Comb. Units	1.087	1.3%	11090	1144002

Volume ESALs 1921432

4-Lane Correction Factor = 0.45

8th Avenue (Low)	20-Year HMA Design ESALs =	864644	ESALs

Future Mainline PCCP ESAL Calculations

30-Year Design Volume = (2017 Volume + 2047 Volume) / 2 =

Design Vol= **9933** + **13854** = **11893** **AADT**

30-Year Design ESALs = Design AADT X 365 Days/yr X 30 Years X ESAL Factor

Vehicle Class	PCCP ESAL Factor	% of Total	Design AADT	30-Year ESALs
Cars	0.003	96.0%	11893	375062
Single Units	0.285	2.7%	11893	1002119
Comb. Units	1.692	1.3%	11893	2864535

Volume 79208 ESALs 4241716

4-Lane Correction Factor = 0.45

8th Avenue (Low)	30-Year PCCP Design ESALs =	1908772	ESALs

8th Ave ESAL Calcs (Avg load) **Federal Blvd. 6th Ave to Holden Place** 4-lane

Future Traffic Volume Calculations

Given: Volumes developed from 2009 Counts

Volumes:	E/O Fed.	W/O Fed.
2012 AADT	**14,500**	9000
2035 AADT	**18,100**	11500
Annual Growth Factor	1.0116	
Distribution:	Uniform	

Year	Volume AADT	**Given 2012 AADT =**	Year	Volume AADT	
2012	11750	**11750**	2033	14970	
2013	11886		2034	15144	**Calc.**
2014	12024	**2017**	2035	15319	**20-Year**
2015	12164	**Build**	2036	15497	**AADT =**
2016	12305	**Year**	2037	15677	**15677**
2017	12447	**12447**	2038	15859	
2018	12592		2039	16043	
2019	12738		2040	16229	
2020	12886		2041	16417	
2021	13035		2042	16607	
2022	13186		2043	16800	
2023	13339		2044	16995	**Calc.**
2024	13494		2045	17192	**30-Year**
2025	13651		2046	17392	**AADT =**
2026	13809		2047	17593	**17,593**
2027	13969		2048	17797	
2028	14131		2049	18004	
2029	14295	**Given**	2050	18213	
2030	14461	**20-Year**			
2031	14629	**AADT =**			
2032	14798	**14800**			

Design ESAL Calculations =>

Future 8th Avenue HMA ESAL Calculations

20-Year Design Volume = (2012 Volume + 2032 Volume) / 2 =

Design Vol= **12447** **+** **15677** **=** **14062** **AADT**

20-Year Design ESALs = Design AADT X 365 Days/yr X 20 Years X ESAL Factor

Vehicle Class	Avg ESAL Factor	% of Total	Design AADT	20-Year ESALs
Cars	0.003	96.0%	14062	295643
Single Units	0.249	2.7%	14062	690142
Comb. Units	1.087	1.3%	14062	1450601

Volume ESALs 2436385

4-Lane Correction Factor = 0.45

8th Ave (Avg Load)	20-Year HMA Design ESALs =	1096373	ESALs

Future Mainline PCCP ESAL Calculations

30-Year Design Volume = (2012 Volume + 2042 Volume) / 2 =

Design Vol= **12447** **+** **17593** **=** **15020** **AADT**

30-Year Design ESALs = Design AADT X 365 Days/yr X 30 Years X ESAL Factor

Vehicle Class	Avg ESAL Factor	% of Total	Design AADT	30-Year ESALs
Cars	0.003	96.0%	15020	473683
Single Units	0.285	2.7%	15020	1265621
Comb. Units	1.692	1.3%	15020	3617752

Volume 79208 ESALs 5357056

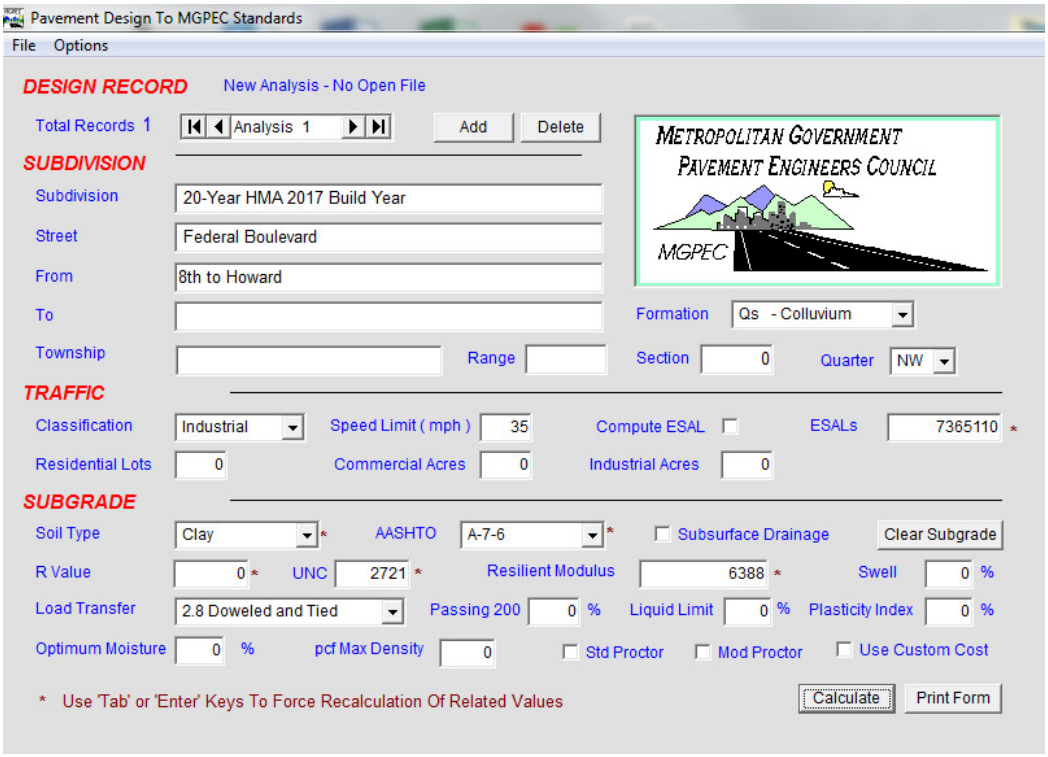
4-Lane Correction Factor = 0.45

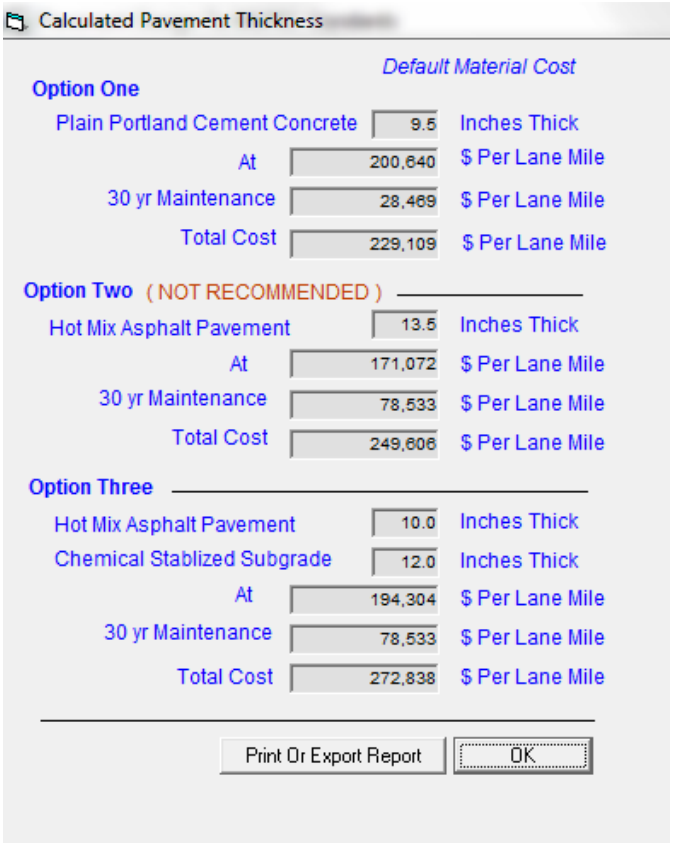
8th Ave (Avg Load)	30-Year PCCP Design ESALs =	2410675	ESALs

Appendix D- Pavement Design Calculations

Project NHPP 2873-172 (19957)

MGPEC 20-Year HMA Design
2017 Build Year Traffic





1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
Yeh & Associates, Inc.

Flexible Structural Design Module

Federal Boulevard - 8th Avenue North
211-117
R = 5
Based on 2017 construction

Flexible Structural Design

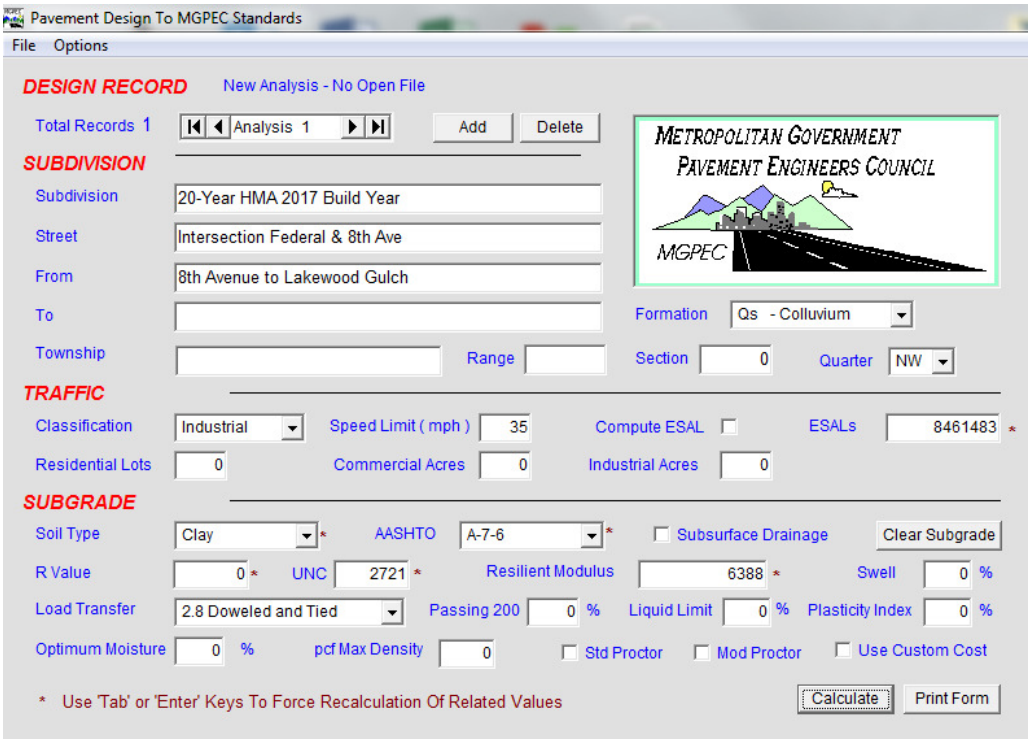
18-kip ESALs Over Initial Performance Period	7,365,110
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	95 %
Overall Standard Deviation	0.44
Roadbed Soil Resilient Modulus	3,025 psi
Stage Construction	1
Calculated Design Structural Number	6.31 in

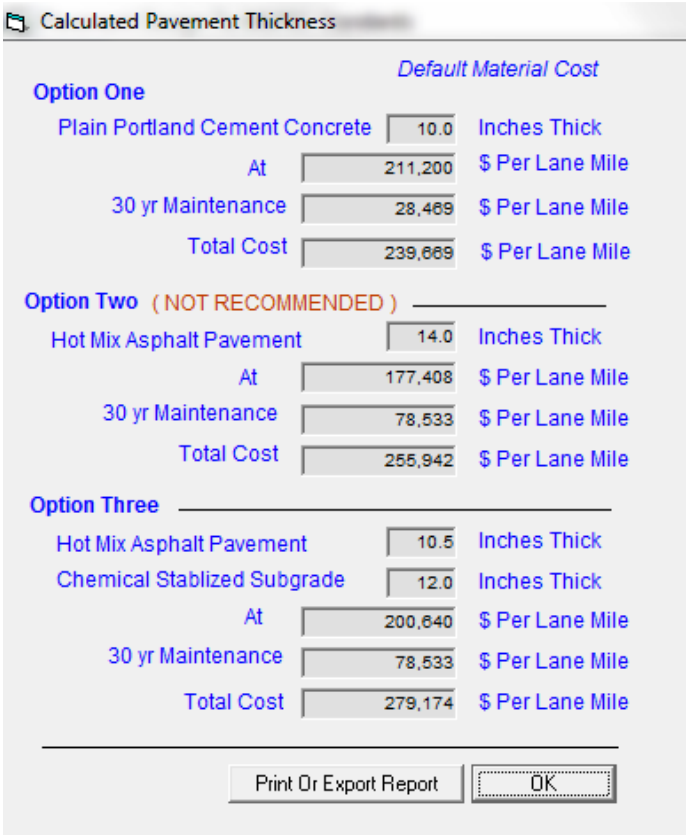
Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	HMA	0.44	1	12.5	36	5.50
2	ABC Class 6	0.15	1	6	36	0.90
Total	-	-	-	18.50	-	6.40

Project NHPP 2873-172 (19957)

MGPEC 20-Year HMA Design
2017 Build Year Traffic





1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
Yeh & Associates, Inc.

Flexible Structural Design Module

Federal Boulevard - 8th Avenue North
Intersection of Federal Boulevard and 8th Avenue
211-117
R = 5
Based on 2017 construction

Flexible Structural Design

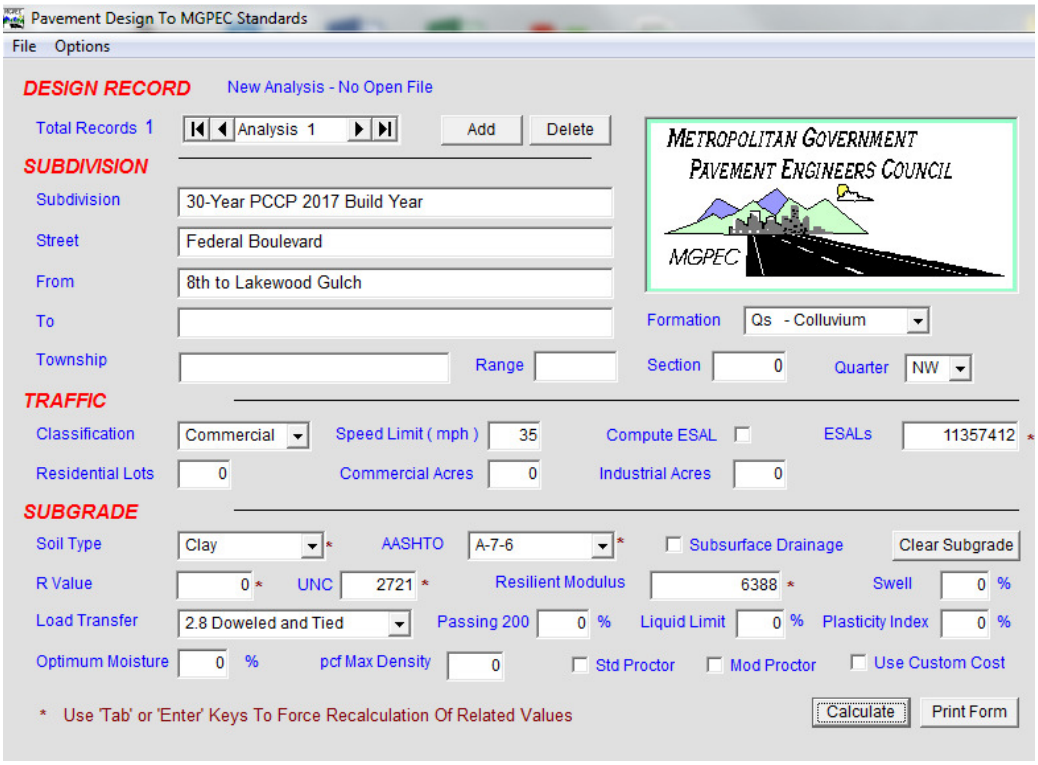
18-kip ESALs Over Initial Performance Period	8,461,483
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	95 %
Overall Standard Deviation	0.44
Roadbed Soil Resilient Modulus	3,025 psi
Stage Construction	1
Calculated Design Structural Number	6.42 in

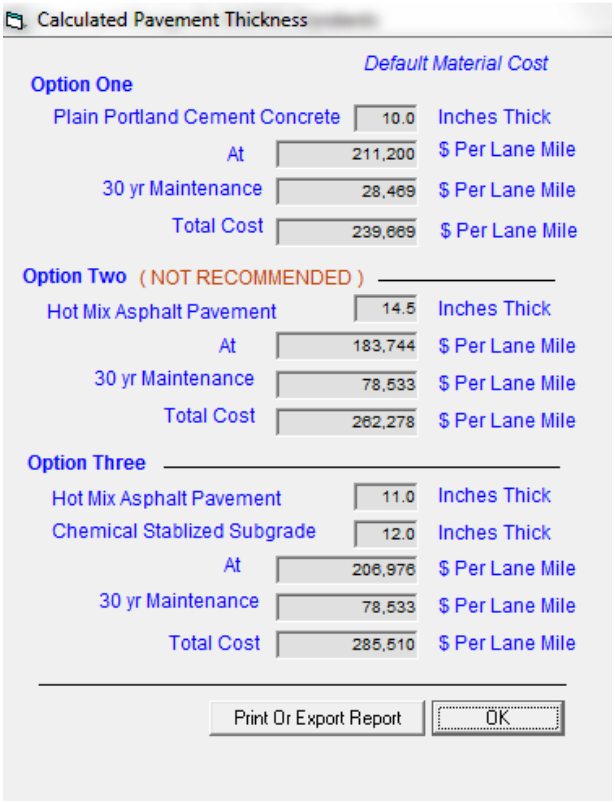
Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	HMA	0.44	1	12.75	36	5.61
2	ABC Class 6	0.15	1	6	36	0.90
Total	-	-	-	18.75	-	6.51

Project NHPP 2873-172 (19957)

MGPEC 30-Year PCCP Design
2017 Build Year Traffic





Rigid Pavement Design - Based on AASHTO Supplemental Guide

Reference: *LTPP DATA ANALYSIS - Phase I: Validation of Guidelines for k-Value Selection and Concrete Pavement Performance Prediction*

I. General

Agency:	CCD / CDOT
Street Address:	
City:	Denver
State:	CO
Project Number:	211-117
ID:	Default
Description:	Federal Boulevard 2017 Build Year
Location:	8th to Howard

II. Design

Serviceability

Initial Serviceability, P1:	4.5	
Terminal Serviceability, P2:	2.5	

PCC Properties

28-day Mean Modulus of Rupture, $(S'_c)'$:	650	psi
Elastic Modulus of Slab, E_c:	3,400,000	psi
Poisson's Ratio for Concrete, m:	0.15	

Base Properties

Elastic Modulus of Base, E_b:	15,000	psi
Design Thickness of Base, H_b:	6.0	in
Slab-Base Friction Factor, f:	1.0	

Reliability and Standard Deviation

Reliability Level (R):	95.0	%
Overall Standard Deviation, S_0:	0.34	

Climatic Properties

Mean Annual Wind Speed, WIND:	9.0	mph
Mean Annual Air Temperature, TEMP:	50.0	°F
Mean Annual Precipitation, PRECIP:	15.0	in

Subgrade k-Value

50 psi/in

Design ESALs

11.3 million

Pavement Type, Joint Spacing (L)

- (•) JPCP
- ( ) JRCP
- ( ) CRCP

Joint Spacing: 15.0 ft

JPCP

Effective Joint Spacing: 180 in

Edge Support

- ( ) Conventional 12-ft wide traffic lane
- (•) Conventional 12-ft wide traffic lane + tied PCC
- ( ) 2-ft widened slab w/conventional 12-ft traffic lane

Edge Support Factor: 0.94

Sensitivity Analysis

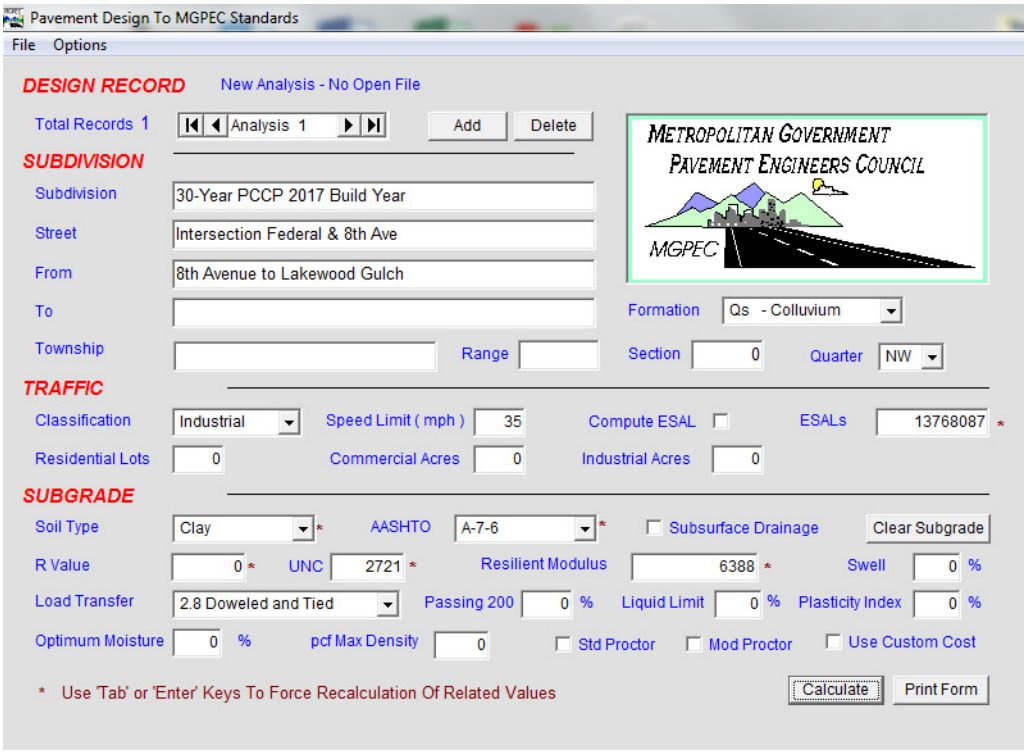
Slab Thickness used for Sensitivity Analysis: 10.25 in

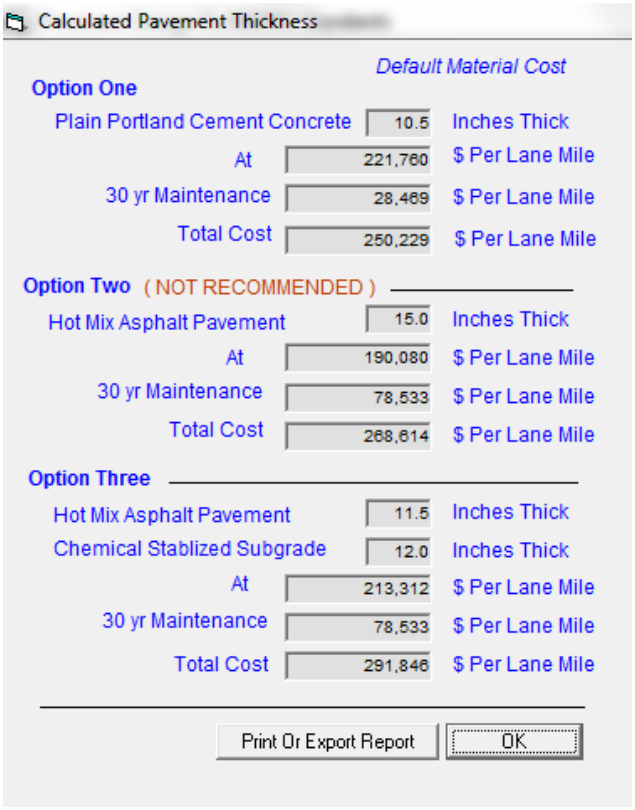
- ( ) Modulus of Rupture
- ( ) Elastic Modulus (Slab)
- ( ) Elastic Modulus (Base)
- (•) Base Thickness
- ( ) k-Value
- ( ) Joint Spacing
- ( ) Reliability
- ( ) Standard Deviation

Calculated Slab Thickness for Above Inputs: 10.25 in

Project NHPP 2873-172 (19957)

MGPEC 30-Year PCCP Design
2017 Build Year Traffic





Rigid Pavement Design - Based on AASHTO Supplemental Guide

Reference: *LTPP DATA ANALYSIS - Phase I: Validation of Guidelines for k-Value Selection and Concrete Pavement Performance Prediction*

I. General

Agency:	CCD / CDOT
Street Address:	
City:	Denver
State:	CO
Project Number:	211-117
ID:	Default
Description:	Federal Blvd & 8th Ave Intersection
Location:	8th to Howard

II. Design

Serviceability

Initial Serviceability, P1:	4.5	
Terminal Serviceability, P2:	2.5	

PCC Properties

28-day Mean Modulus of Rupture, $(S'_c)'$:	650	psi
Elastic Modulus of Slab, E_c:	3,400,000	psi
Poisson's Ratio for Concrete, m:	0.15	

Base Properties

Elastic Modulus of Base, E_b:	15,000	psi
Design Thickness of Base, H_b:	6.0	in
Slab-Base Friction Factor, f:	1.0	

Reliability and Standard Deviation

Reliability Level (R):	95.0	%
Overall Standard Deviation, S_0:	0.34	

Climatic Properties

Mean Annual Wind Speed, WIND:	9.0	mph
Mean Annual Air Temperature, TEMP:	50.0	°F
Mean Annual Precipitation, PRECIP:	15.0	in

Subgrade k-Value

50 psi/in

Design ESALs

13.8 million

Pavement Type, Joint Spacing (L)

- (•) JPCP
- ( ) JRCP
- ( ) CRCP

Joint Spacing: 15.0 ft

JPCP

Effective Joint Spacing: 180 in

Edge Support

- ( ) Conventional 12-ft wide traffic lane
- (•) Conventional 12-ft wide traffic lane + tied PCC
- ( ) 2-ft widened slab w/conventional 12-ft traffic lane

Edge Support Factor: 0.94

Sensitivity Analysis

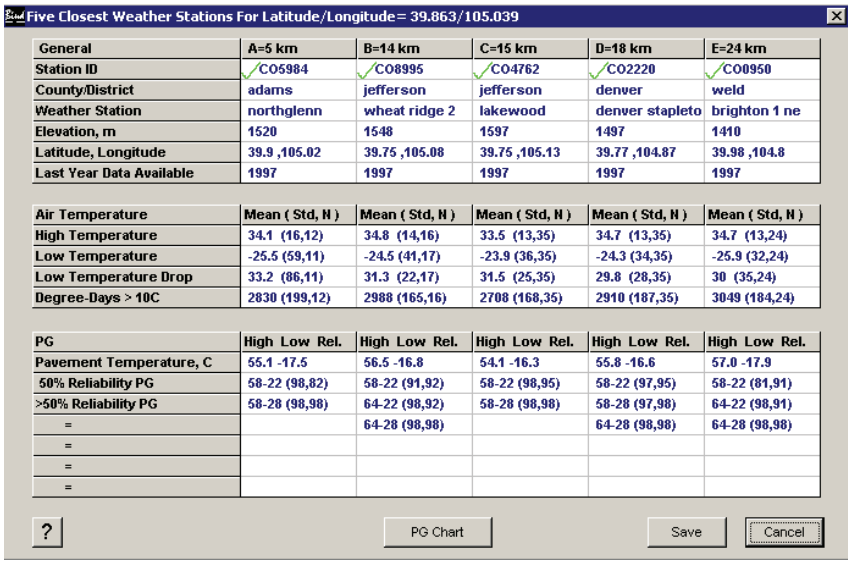
Slab Thickness used for Sensitivity Analysis: 10.54 in

- ( ) Modulus of Rupture
- ( ) Elastic Modulus (Slab)
- ( ) Elastic Modulus (Base)
- (•) Base Thickness
- ( ) k-Value
- ( ) Joint Spacing
- ( ) Reliability
- ( ) Standard Deviation

Calculated Slab Thickness for Above Inputs: 10.54 in

Federal Boulevard, 8th Avenue - North

LTPP Binder Selection Guidelines



Five Closest Weather Stations For Latitude/Longitude= 39.863/105.039

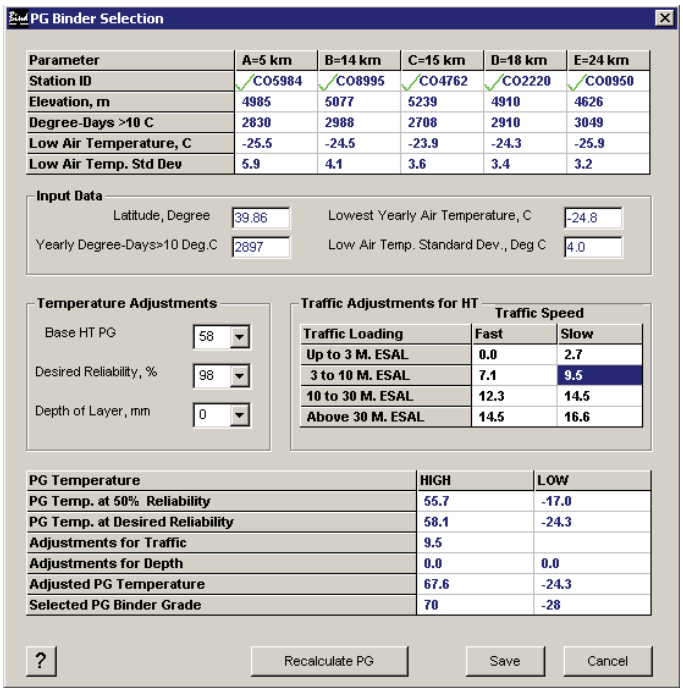
General	A=5 km	B=14 km	C=15 km	D=18 km	E=24 km
Station ID	✓CO5984	✓CO8995	✓CO4762	✓CO2220	✓CO0950
County/District	adams	jefferson	jefferson	denver	weld
Weather Station	northglenn	wheat ridge 2	lakewood	denver stapleto	brighton 1 ne
Elevation, m	1520	1548	1597	1497	1410
Latitude, Longitude	39.9 ,105.02	39.75 ,105.08	39.75 ,105.13	39.77 ,104.87	39.98 ,104.8
Last Year Data Available	1997	1997	1997	1997	1997

Air Temperature	Mean (Std, N)	Mean (Std, N)	Mean (Std, N)	Mean (Std, N)	Mean (Std, N)
High Temperature	34.1 (16,12)	34.8 (14,16)	33.5 (13,35)	34.7 (13,35)	34.7 (13,24)
Low Temperature	-25.5 (59,11)	-24.5 (41,17)	-23.9 (36,35)	-24.3 (34,35)	-25.9 (32,24)
Low Temperature Drop	33.2 (86,11)	31.3 (22,17)	31.5 (25,35)	29.8 (28,35)	30 (35,24)
Degree-Days > 10C	2830 (199,12)	2988 (165,16)	2708 (168,35)	2910 (187,35)	3049 (184,24)

PG	High Low Rel.	High Low Rel.	High Low Rel.	High Low Rel.	High Low Rel.
Pavement Temperature, C	55.1 -17.5	56.5 -16.8	54.1 -16.3	55.8 -16.6	57.0 -17.9
50% Reliability PG	58-22 (98,82)	58-22 (91,92)	58-22 (98,95)	58-22 (97,95)	58-22 (81,91)
>50% Reliability PG	58-28 (98,98)	64-22 (98,92)	58-28 (98,98)	58-28 (97,98)	64-22 (98,91)
=		64-28 (98,98)		64-28 (98,98)	64-28 (98,98)
=					
=					
=					

? PG Chart Save Cancel

Top Lift Binder PG 70-28 => not available
Use PG 76-28



PG Binder Selection

Parameter	A=5 km	B=14 km	C=15 km	D=18 km	E=24 km
Station ID	✓CO5984	✓CO8995	✓CO4762	✓CO2220	✓CO0950
Elevation, m	4985	5077	5239	4910	4626
Degree-Days >10 C	2830	2988	2708	2910	3049
Low Air Temperature, C	-25.5	-24.5	-23.9	-24.3	-25.9
Low Air Temp. Std Dev	5.9	4.1	3.6	3.4	3.2

Input Data
Latitude, Degree 39.86 Lowest Yearly Air Temperature, C -24.8
Yearly Degree-Days>10 Deg.C 2897 Low Air Temp. Standard Dev., Deg C 4.0

Temperature Adjustments
Base HT PG 58
Desired Reliability, % 98
Depth of Layer, mm 0

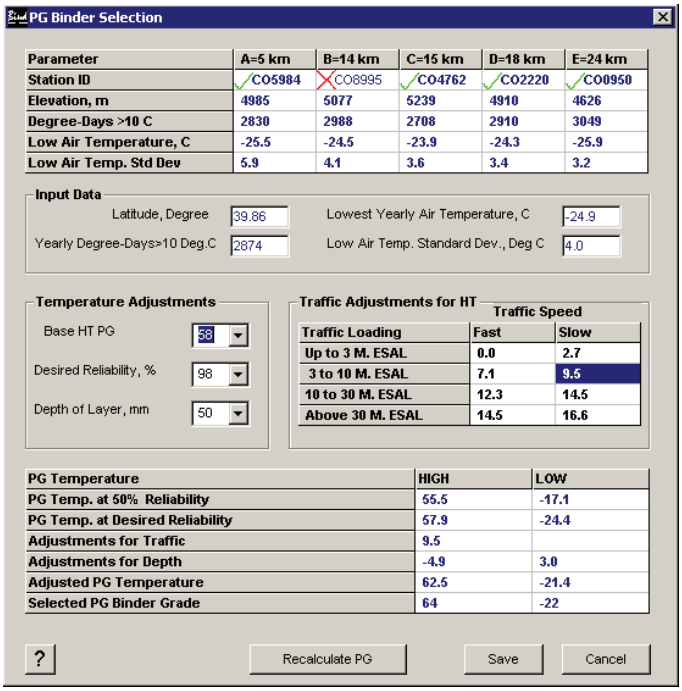
Traffic Adjustments for HT — Traffic Speed

Traffic Loading	Fast	Slow
Up to 3 M. ESAL	0.0	2.7
3 to 10 M. ESAL	7.1	9.5
10 to 30 M. ESAL	12.3	14.5
Above 30 M. ESAL	14.5	16.6

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	55.7	-17.0
PG Temp. at Desired Reliability	58.1	-24.3
Adjustments for Traffic	9.5	
Adjustments for Depth	0.0	0.0
Adjusted PG Temperature	67.6	-24.3
Selected PG Binder Grade	70	-28

? Recalculate PG Save Cancel

Lower Lift Binder PG 64-22



PG Binder Selection

Parameter	A=5 km	B=14 km	C=15 km	D=18 km	E=24 km
Station ID	✓CO5984	✗CO8995	✓CO4762	✓CO2220	✓CO0950
Elevation, m	4985	5077	5239	4910	4626
Degree-Days >10 C	2830	2988	2708	2910	3049
Low Air Temperature, C	-25.5	-24.5	-23.9	-24.3	-25.9
Low Air Temp. Std Dev	5.9	4.1	3.6	3.4	3.2

Input Data
Latitude, Degree 39.86 Lowest Yearly Air Temperature, C -24.9
Yearly Degree-Days>10 Deg.C 2874 Low Air Temp. Standard Dev., Deg C 4.0

Temperature Adjustments
Base HT PG 58
Desired Reliability, % 98
Depth of Layer, mm 50

Traffic Adjustments for HT — Traffic Speed

Traffic Loading	Fast	Slow
Up to 3 M. ESAL	0.0	2.7
3 to 10 M. ESAL	7.1	9.5
10 to 30 M. ESAL	12.3	14.5
Above 30 M. ESAL	14.5	16.6

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	55.5	-17.1
PG Temp. at Desired Reliability	57.9	-24.4
Adjustments for Traffic	9.5	
Adjustments for Depth	-4.9	3.0
Adjusted PG Temperature	62.5	-21.4
Selected PG Binder Grade	64	-22

? Recalculate PG Save Cancel

Appendix E- User Cost Calculations

CDOT REPORT - Summary Input and Output for the Single Lane Closure Strategy

	INPUT DATA	
Project Name	Federal Blvd. 8th -North 2023	
Freeway Name	SH 88	
Input Filename		
Project Start Date		
Project End Date		
Design Speed	40 mph	
Speed Limit	40 mph	
Workzone Speed Limit	35 mph	
Grade	2.0 %	
Work Zone Length	1.00 miles	
Total Number of Lanes	6	
Number of Open Lanes	5	
Number of Temporary Lanes	0	
AADT, Directional	39276	
Percentage of Single Unit Trucks	3.3 %	
Percentage of Combination Trucks	1.4 %	
Functional Class	Urban Principal Arterial (Weekday)	
	OUTPUT SUMMARY	
TYPE OF WORK	**ADDITIONAL USER COST DUE TO WORKZONE**	**DURATION**
202-Removal of Asphalt (Planing)	$4,595.15	7
403-Stone Mastic Asphalt	$4,648.97	7
TOTAL ADDL. USER COST	$9,244.12	14
TOTAL USER COST FOR NORMAL CONDITION (WITH NO WORKZONE) FOR A DURATION OF 14 DAYS = $62,365.81		
Disclaimer:		
The values presented in this program are intended to provide guidelines only. Engineering judgement must be applied to use these values. No one but the user can assure that these results are properly applied.		

CDOT REPORT - Summary Input and Output for the Single Lane Closure Strategy

	INPUT DATA	
Project Name	Federal Blvd. 8th -North 2033	
Freeway Name	SH 88	
Input Filename		
Project Start Date		
Project End Date		
Design Speed	40 mph	
Speed Limit	40 mph	
Workzone Speed Limit	35 mph	
Grade	2.0 %	
Work Zone Length	1.00 miles	
Total Number of Lanes	6	
Number of Open Lanes	5	
Number of Temporary Lanes	0	
AADT, Directional	41796	
Percentage of Single Unit Trucks	3.3 %	
Percentage of Combination Trucks	1.4 %	
Functional Class	Urban Principal Arterial (Weekday)	
	OUTPUT SUMMARY	
TYPE OF WORK	**ADDITIONAL USER COST DUE TO WORKZONE**	**DURATION**
202-Removal of Asphalt (Planing)	$4,918.42	7
403-Stone Mastic Asphalt	$4,980.95	7
TOTAL ADDL. USER COST	$9,899.37	14
TOTAL USER COST FOR NORMAL CONDITION (WITH NO WORKZONE) FOR A DURATION OF 14 DAYS = $66,384.35		
Disclaimer:		
The values presented in this program are intended to provide guidelines only. Engineering judgement must be applied to use these values. No one but the user can assure that these results are properly applied.		

CDOT REPORT - Summary Input and Output for the Single Lane Closure Strategy

	INPUT DATA	
Project Name	Federal Blvd. 8th -North 2043	
Freeway Name	SH 88	
Input Filename		
Project Start Date		
Project End Date		
Design Speed	40 mph	
Speed Limit	40 mph	
Workzone Speed Limit	35 mph	
Grade	2.0 %	
Work Zone Length	1.00 miles	
Total Number of Lanes	6	
Number of Open Lanes	5	
Number of Temporary Lanes	0	
AADT, Directional	44316	
Percentage of Single Unit Trucks	3.3 %	
Percentage of Combination Trucks	1.4 %	
Functional Class	Urban Principal Arterial (Weekday)	
	OUTPUT SUMMARY	
TYPE OF WORK	**ADDITIONAL USER COST DUE TO WORKZONE**	**DURATION**
202-Removal of Asphalt (Planing)	$5,246.52	7
403-Stone Mastic Asphalt	$5,318.64	7
TOTAL ADDL. USER COST	$10,565.15	14
TOTAL USER COST FOR NORMAL CONDITION (WITH NO WORKZONE) FOR A DURATION OF 14 DAYS = $70,404.97		
Disclaimer:		
The values presented in this program are intended to provide guidelines only. Engineering judgement must be applied to use these values. No one but the user can assure that these results are properly applied.		

CDOT REPORT - Summary Input and Output for the Single Lane Closure Strategy

	INPUT DATA	
Project Name	Federal Blvd. 8th -No. 2035 PCC	
Freeway Name	SH 88	
Input Filename		
Project Start Date		
Project End Date		
Design Speed	40 mph	
Speed Limit	40 mph	
Workzone Speed Limit	35 mph	
Grade	2.0 %	
Work Zone Length	1.00 miles	
Total Number of Lanes	6	
Number of Open Lanes	5	
Number of Temporary Lanes	0	
AADT, Directional	42300	
Percentage of Single Unit Trucks	3.3 %	
Percentage of Combination Trucks	1.4 %	
Functional Class	Urban Principal Arterial (Weekday)	
	OUTPUT SUMMARY	
TYPE OF WORK	**ADDITIONAL USER COST DUE TO WORKZONE**	**DURATION**
202-Removal of Concrete (Diamond Grinding)	$4,983.64	7
210-Replace Concrete Pavement	$5,051.20	7
412-Routing & Sealing PCCP Cracks	$5,048.02	7
TOTAL ADDL. USER COST	$15,082.86	21
TOTAL USER COST FOR NORMAL CONDITION (WITH NO WORKZONE) FOR A DURATION OF 21 DAYS = $100,782.46		
Disclaimer:		
The values presented in this program are intended to provide guidelines only. Engineering judgement must be applied to use these values. No one but the user can assure that these results are properly applied.		

Future Traffic Volumes for Highway 088

From RefPoint 0.1 To RefPoint 1.2

Route	Ref Point	End Ref Point	Start Point Description	AADT	AADTYR	AADT Single Trucks	AADT Comb. Trucks	Design Hour Volume (% of AADT)	AADT 2023	AADT Single Trucks 2023	AADT Comb. Trucks 2023
088A	0	0.140	ON SH 88, FEDERAL BLVD S/O SH 40, COLFAX AVE	35,000	2010	1300	460	9	37,958	1,410	499
088A	0.140	0.745	ON SH 88, FEDERAL BLVD N/O 8TH AVE, DENVER	34,000	2010	1200	480	9	36,652	1,294	517
088A	0.745	1.090	ON SH 88, FEDERAL BLVD N/O SH 6, 6TH AVE, DENVER	36,000	2010	1200	500	9	39,276	1,309	546
088A	1.090	1.360	ON SH 88, FEDERAL BLVD S/O 5TH AVE, DENVER	42,000	2010	1400	590	9	47,187	1,573	663
088A	1.360	1.978	ON SH 88, FEDERAL BLVD S/O 2ND AVE EAST & N/O 2ND AVE WEST, DENVER	42,000	2010	1400	590	8	47,187	1,573	663

If you notice an error, bug or have any questions, Please E-mail us.

Year 10 HMA Rehabilitation

Future Traffic Volumes for Highway 088

From RefPoint 0.1 To RefPoint 1.2

Route	Ref Point	End Ref Point	Start Point Description	AADT	AADTYR	AADT Single Trucks	AADT Comb. Trucks	Design Hour Volume (% of AADT)	AADT 2033	AADT Single Trucks 2033	AADT Comb. Trucks 2033
088A	0	0.140	ON SH 88, FEDERAL BLVD S/O SH 40, COLFAX AVE	35,000	2010	1300	460	9	40,233	1,494	529
088A	0.140	0.745	ON SH 88, FEDERAL BLVD N/O 8TH AVE, DENVER	34,000	2010	1200	480	9	38,692	1,366	546
088A	0.745	1.090	ON SH 88, FEDERAL BLVD N/O SH 6, 6TH AVE, DENVER	36,000	2010	1200	500	9	41,796	1,393	581
088A	1.090	1.360	ON SH 88, FEDERAL BLVD S/O 5TH AVE, DENVER	42,000	2010	1400	590	9	51,177	1,706	719
088A	1.360	1.978	ON SH 88, FEDERAL BLVD S/O 2ND AVE EAST & N/O 2ND AVE WEST, DENVER	42,000	2010	1400	590	8	51,177	1,706	719

If you notice an error, bug or have any questions, Please E-mail us.

Year 20 HMA Rehabilitation

Future Traffic Volumes for Highway 088

From RefPoint 0.1 To RefPoint 1.2

Route	Ref Point	End Ref Point	Start Point Description	AADT	AADTYR	AADT Single Trucks	AADT Comb. Trucks	Design Hour Volume (% of AADT)	AADT 2043	AADT Single Trucks 2043	AADT Comb. Trucks 2043
088A	0	0.140	ON SH 88, FEDERAL BLVD S/O SH 40, COLFAX AVE	35,000	2010	1300	460	9	42,508	1,579	559
088A	0.140	0.745	ON SH 88, FEDERAL BLVD N/O 8TH AVE, DENVER	34,000	2010	1200	480	9	40,732	1,438	575
088A	0.745	1.090	ON SH 88, FEDERAL BLVD N/O SH 6, 6TH AVE, DENVER	36,000	2010	1200	500	9	44,316	1,477	616
088A	1.090	1.360	ON SH 88, FEDERAL BLVD S/O 5TH AVE, DENVER	42,000	2010	1400	590	9	55,167	1,839	775
088A	1.360	1.978	ON SH 88, FEDERAL BLVD S/O 2ND AVE EAST & N/O 2ND AVE WEST, DENVER	42,000	2010	1400	590	8	55,167	1,839	775

If you notice an error, bug or have any questions, Please E-mail us.

Year 30 HMA Rehabilitation

Future Traffic Volumes for Highway 088

From RefPoint 0.1 To RefPoint 1.21

Route	Ref Point	End Ref Point	Start Point Description	AADT	AADTYR	AADT Single Trucks	AADT Comb. Trucks	Design Hour Volume (% of AADT)	AADT 2035	AADT Single Trucks 2035	AADT Comb. Trucks 2035
088A	0	0.140	ON SH 88, FEDERAL BLVD S/O SH 40, COLFAX AVE	35,000	2010	1300	460	9	40,688	1,511	535
088A	0.140	0.745	ON SH 88, FEDERAL BLVD N/O 8TH AVE, DENVER	34,000	2010	1200	480	9	39,100	1,380	552
088A	0.745	1.090	ON SH 88, FEDERAL BLVD N/O SH 6, 6TH AVE, DENVER	36,000	2010	1200	500	9	42,300	1,410	588
088A	1.090	1.360	ON SH 88, FEDERAL BLVD S/O 5TH AVE, DENVER	42,000	2010	1400	590	9	51,975	1,733	730
088A	1.360	1.978	ON SH 88, FEDERAL BLVD S/O 2ND AVE EAST & N/O 2ND AVE WEST, DENVER	42,000	2010	1400	590	8	51,975	1,733	730

If you notice an error, bug or have any questions, Please E-mail us.

Year 22 PCCP Rehabilitation

Appendix F- Life Cycle Quantities, Costs and Report

Federal Blvd., 8th Ave to Lakewood Gulch **Input Quantities for Life Cycle Cost**

2/17/2012

Given: The Life cycle cost will be done comparing one mile for both directions.

Section Length = 5280 feet Station 0 to 52.8

(One Direction Only) 1 mile

Project Width = 82 feet 3 - 11 foot driving lanes in each direction, 1 - 16 foot center turn lane

27.3 yd

Number of sq yds = 48107 - one mile - one direction

Assumptions:
- Most of the alignment will require removal of the old pavement and replacement with a new pavement, and the subgrade treatment will be the same for either HMA or PCC pavement, so no subgrade costs or user costs are being considered for the life cycle cost.
- Night Lane closures will be used for rehabilitation construction & one lane will be provided for traffic control

HMA Time, Quantities and Costs

Both HMA & PCC Designs call for 6 inches of aggregate base course (ABC), so no subbase treatment will be considered for the LCCA

Mixes Proposed = 10 inches S(100) with PG 64-22 Binder

2 Inches SMA containing PG 76-28 Binder

Total Tonnage

Bottom Mat =	10.0	inches S(100) with PG 64-22	26459	tons
Top Mat =	2.0	Inches SMA containing PG 76-28	5292	tons
		Total HMA	31750	tons

HMA - Costs for LCC Analysis

+/- 10%

Initial Pavement Construction			**low $/ton**	**most likely $/ton**	**high $/ton**	**Lowest Treatment Cost**	**Most Likely Treatment Cost**	**Highest Treatment Cost**
22,293 yd2 @ 10.0"=	26459	tons X	$50.00	$55.00	$60.00	$1,322,933	$1,455,227	$1,587,520
22,293 yd2 @ 2.0"=	5292	tons X	$75.00	$85.00	$95.00	$396,880	$449,797	$502,715
						Lowest	Most Likely	Highest
CDOT 2012 Pavement Design Manual calls for additional costs to address Preliminary Engineering (10%), Traffic Control (15%), and Construction Engineering (18.1%)					Subtotal =	$1,719,813	$1,905,024	$2,090,235
						Lowest	**Most Likely**	**Highest**
With Additional Costs CE, PE & Traffic = 43.1%					**Total =**	**$2,461,053**	**$2,726,089**	**$2,991,126**

HMA Rehabilitation Treatment = 2 " mill and 2" SX(100) PG 76-28 at 11 years, 21 years, 31 years and 41

Rehabilitation Costs

SMA Cost = Same as Above

			low $/sq yd	most likely $/ton	high $/ton	Lowest Treatment Cost		Most Likely Treatment Cost		Highest Treatment Cost
Milling	48,107	yd2 X	$1.75	$2.00	$2.25	$84,187		$96,213		$108,240
42,240 yd2 @ 2.0"=	5292	tons X	$75.00	$85.00	$95.00	$396,880		$449,797		$502,715
					Subtotal =	$481,067		$546,011		$610,955

CDOT 2011 Pavement Design Manual calls for additional costs to address Preliminary Engineering (10%), Traffic Control (15%), and Construction Engineering (18.1%)

With Additional Costs CE, PE & Traffic = 43.1%

Lowest	Most Likely	Highest
$688,406	**$781,341**	**$874,276**

Salvage Value (SV) for 1 year on last rehab = N/A with 10 year rehab cycles.

SV = (1-(LA/LE)*C

Where:

SV = Salvage Value

LA = Portion of Design Life Consumed

LE = Design Life of Rehabilitation

C = Cost of Rehabilitation

Time Rehab Milling (one mile / one direction) (All work done at night between 8 PM and 6 AM, 10 hour closure)

Milling Time **7** **days** One pass per lane for one mile of project (82 ft/12 ft/pass = 7 passes) @ 1.0 miles

			48,107	yd2 X	220	lbs/yd2-in /	2000	lb/ton =	5292	tons
Overlay Time	**7**	**days**		2.0" in one lift at app.		800	tons/night =	7	nights	

The calculated user costs were as follows:

The CDOT Work Zone User Cost Program was used to determine user costs for the rehabilitation cycles.

		Work Zone Capacity /Lane
(Year 2023) 10-Year Rehabilitation =	**$9,244**	1522
(Year 2033) 20-Year Rehabilitation =	**$9,899**	1426
(Year 2043) 30-Year Rehabilitation =	**$10,565**	1421

Maintenance Costs were taken from the 2012 CDOT Pavement Design Manual (Table 10.4) CDOT Region 6

HMA Cost per Lane Mile/yr = $2,520 => one mile - 7 lanes wide (82ft) (X7) = **$17,640** **per year**

PCCP Time, Quantities and Cost

Initial Pavement Construction

Assumptions:
- 6-lane / two-way traffic will be maintained at all times for original construction by using detours, therefore, current flow is assumed and no difference in user costs will be considered for original construction
- Single lane closures will be used for rehabilitation construction at night

The pavement design calls for a 10.5 inch PCC pavement and PCC costs were obtained from the CDOT Cost data book for 2010

						Lowest Treatment Cost	**Most Likely Treatment Cost**	**Highest Treatment Cost**
PCC (in) =	10.5	**$/sq yd-in**	**$/sq yd-in**	**$/sq yd-in**				
48107	yd2 X	$3.50	$4.00	$4.50	subtotal =	$1,767,920	$2,020,480	$2,273,040
Initial Cost With Additional Costs								
10% (PE), 15% (Traffic), & 18.1% (CE)PE = 43.1%						**$2,529,894**	**$2,891,307**	**$3,252,720**

Rehabilitation Treatments

Treatments = 0.5% slab replacement, sawing and sealing joints, and grinding travel lanes

Time for Rehab Treatments: **Total = 21 days**

Slab Replacment - 7 nights lane closure
Grinding Travel Lanes - 7 nights / one lane per night (12' X 1 mile)
Saw and Seal Joints - 7 nights / one lane per night (trans. and long. Joints)

1	miles X	5280	ft/mile /	15	ft/slab X	8	slabs wide =			2816	slabs
0.50%	X	2816	slabs =	14	slabs X	20	yd2/slab =			282	yd2
Grinding Trvl Lanes=	1	miles X	1760	yds/miX	66	ft /	3	ft/yd =		38720	yd2
Longitudinal Joints =			1	miles X	5280	ft/mile /	9	long jts		47520	feet
Transverse Joints	1	miles X	5280	ft/mile /	82	ft/t-jt /	15	jt sp		28864	feet
							Total Joint filling			76384	lin ft

PCC Rehabilitation Treatment Costs

			Lowest		**Most Likely**		**Highest**	
		Slab Replacement	$300	$/yd2	$350	$/yd2	$400	$/yd2
		Saw and Seal Joints	$1.75	$/LF	$2.00	$/LF	$2.25	$/LF
		Grinding lanes	$5.50	$/yd2	$6.00	$/yd2	$6.50	$/yd2
Slab Replacement	282	yd2 X	$84,480		$98,560		$112,640	
Saw and Seal Joints	76384	lin ft X	$133,672		$152,768		$171,864	
Grinding lanes	38720	yd2 X	$212,960		$232,320		$251,680	
			Lowest		Most Likely		Highest	
		Total Rehabilitation Cost Range =	$431,112		$483,648		$536,184	
			Lowest		**Most Likely**		**Highest**	
With Additional Costs CE, PE & Traffic = 43.1%			**$616,921**		**$692,100**		**$767,279**	

The CDOT Work Zone User Cost Program was used to determine user costs for the rehabilitation cycles.

The calculated user costs were as follows:

		Work Zone Capacity
(Year 2037) 22-Year Rehabilitation =	**$15,083**	1421

Maintenance Costs were taken from the 2012 CDOT Pavement Design Manual (Table 10.4) CDOT Region 6

CDOT Region 6

PCC Cost per Lane Mile/yr = $643 => one mile - 7 lanes wide (82ft) (X7) = **$4,501** **per year**

Federal Boulevard, 7th Avenue to Holden Place
40-Year Life Cycle Cost Comparison at 75th Percentile

Statistics	HMA Alternative: Agency Cost	HMA Alternative: User Cost	PCCP Alternative: Agency Cost	PCCP Alternative: User Cost	
Probability Function					
Minimum	$3,996.99	$14.26	$2,943.68	$5.90	
Maximum	$4,756.52	$17.53	$3,652.25	$7.40	
Mean	$4,345.75	$15.84	$3,293.08	$6.64	% Difference =
Median	$4,345.35	$15.85	$3,294.11	$6.64	Higher - Lower
Standard Deviation	$126.31	$0.50	$146.70	$0.23	Lower
Percentile (5%)	$4,138.07	$15.04	$3,047.58	$6.27	
Percentile (10%)	$4,182.71	$15.22	$3,093.44	$6.35	
Percentile (75%)	**$4,434.42**	**$16.18**	**$3,400.17**	**$6.79**	**30.6%** **lower with PCCP**
Percentile (95%)	$4,555.01	$16.66	$3,538.11	$7.01	

Cost in thousands for one mile of Federal Blvd.

RealCost Input Data

1. Economic Variables	
Value of Time for Passenger Cars ($/hour)	$17.00
Value of Time for Single Unit Trucks ($/hour)	$35.00
Value of Time for Combination Trucks ($/hour)	$36.50

2. Analysis Options	
Include User Costs in Analysis	Yes
Include User Cost Remaining Service Life Value	Yes
Use Differential User Costs	Yes
User Cost Computation Method	Specified
Include Agency Cost Remaining Service Life Value	Yes
Traffic Direction	Both
Analysis Period (Years)	40
Beginning of Analysis Period	2013
Discount Rate (%)	3.3
	LCCANORMAL(3.3,0.18)

3. Project Details and Quantity Calculations	
State Route	SH 88, Federal Boulevard
Project Name	Federal Boulevard, 7th Avenue - North
Region	211-117
County	Denver
Analyzed By	R. LaForce
Mileposts	
Begin	0.00
End	1.00
Length of Project (miles)	1.00
Comments	12.0" HMA versus 10.5" PCC on compacted subgrade with 6" ABC at $55/$85/$4.00

4. Traffic Data	
AADT Construction Year (total for both directions)	36,000
Cars as Percentage of AADT (%)	95.3
Single Unit Trucks as Percentage of AADT (%)	3.3
Combination Trucks as Percentage of AADT (%)	1.4
Annual Growth Rate of Traffic (%)	1.3
	LCCATRIANG(0.34,1.34,2.34)
Speed Limit Under Normal Operating Conditions (mph)	40
No of Lanes in Each Direction During Normal Conditions	3
Free Flow Capacity (vphpl)	2167
Rural or Urban Hourly Traffic Distribution	Urban
Queue Dissipation Capacity (vphpl)	2149
Maximum AADT (total for both directions)	350,000
Maximum Queue Length (miles)	1.0

Alternative 1

Initial Construction	HMA Pavement Construction	
Agency Construction Cost ($1000)	$2,726.09	
	LCCATRIANG(2461.053,2726.09 ,2991.126)	
User Work Zone Costs ($1000)	$0.00	
Work Zone Duration (days)	0	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	10.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	17.64	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	40	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	0	24
Second period of lane closure	0	24
Third period of lane closure	0	24
Outbound	Start	End
First period of lane closure	0	24
Second period of lane closure	0	24
Third period of lane closure	0	24

Rehabilitation #1	Mill and 2 Inch Overlay	
Agency Construction Cost ($1000)	$781.34	
	LCCATRIANG(688.406,781.341, 874.276)	
User Work Zone Costs ($1000)	$9.24	
Work Zone Duration (days)	14	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	10.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	17.64	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #2	Mill and 2 Inch Overlay	
Agency Construction Cost ($1000)	$781.34 **LCCATRIANG(688.406,781.341, 874.276)**	
User Work Zone Costs ($1000)	$9.90	
Work Zone Duration (days)	14	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	10.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	17.64	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #3	Mill and 2 Inch Overlay	
Agency Construction Cost ($1000)	$781.34 **LCCATRIANG(688.406,781.341, 874.276)**	
User Work Zone Costs ($1000)	$10.57	
Work Zone Duration (days)	14	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	10.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	17.64	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #4	Mill and 2 Inch Overlay	
Agency Construction Cost ($1000)	$781.34 **LCCATRIANG(688.406,781.341, 874.276)**	
User Work Zone Costs ($1000)	$10.57	
Work Zone Duration (days)	14	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	10.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	17.64	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #5	Mill and 2 Inch Overlay	
Agency Construction Cost ($1000)	$781.34 **LCCATRIANG(688.406,781.341, 874.276)**	
User Work Zone Costs ($1000)	$10.57	
Work Zone Duration (days)	14	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	10.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	17.64	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #6	Mill and 2 Inch Overlay	
Agency Construction Cost ($1000)	$781.34 **LCCATRIANG(688.406,781.341, 874.276)**	
User Work Zone Costs ($1000)	$10.57	
Work Zone Duration (days)	14	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	10.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	17.64	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Alternative 2

Initial Construction	PCC Option	
Agency Construction Cost ($1000)	$2,891.52	**LCCATRIANG(2529.911,2891.894,3252.743)**
User Work Zone Costs ($1000)	$0.00	
Work Zone Duration (days)	0	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	22.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	4.501	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	65	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	0	24
Second period of lane closure	0	24
Third period of lane closure	0	24
Outbound	Start	End
First period of lane closure	0	24
Second period of lane closure	0	24
Third period of lane closure	0	24

Rehabilitation #1	PCC Option	
Agency Construction Cost ($1000)	$692.10	**LCCATRIANG(616.921,692.1,767.279)**
User Work Zone Costs ($1000)	$15.08	
Work Zone Duration (days)	21	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	22.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	4.501	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #2	PCC Option	
Agency Construction Cost ($1000)	$692.10 **LCCATRIANG(616.921,692.1,767.279)**	
User Work Zone Costs ($1000)	$15.08	
Work Zone Duration (days)	21	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	18.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	4.501	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #3	PCC Option	
Agency Construction Cost ($1000)	$692.10 **LCCATRIANG(616.921,692.1,767.279)**	
User Work Zone Costs ($1000)	$15.08	
Work Zone Duration (days)	21	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	18.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	4.501	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

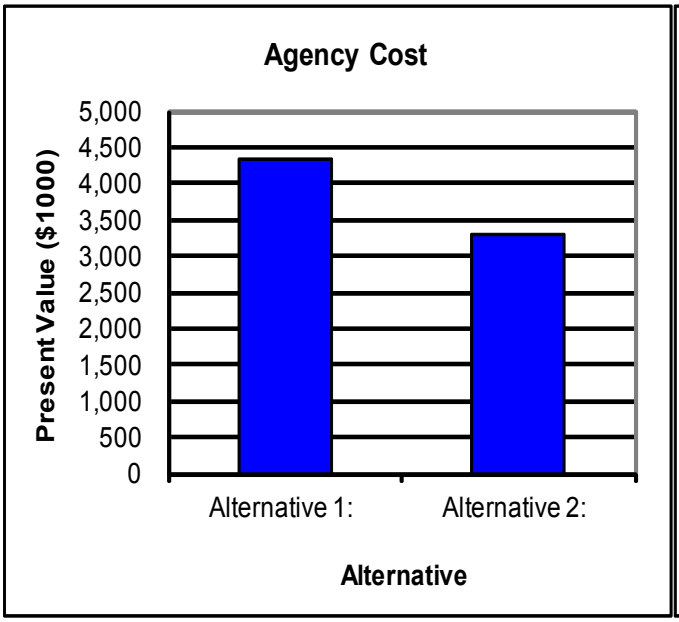
Rehabilitation #4	PCC Option	
Agency Construction Cost ($1000)	$692.10 **LCCATRIANG(616.921,692.1,767.279)**	
User Work Zone Costs ($1000)	$15.08	
Work Zone Duration (days)	21	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	18.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	4.501	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

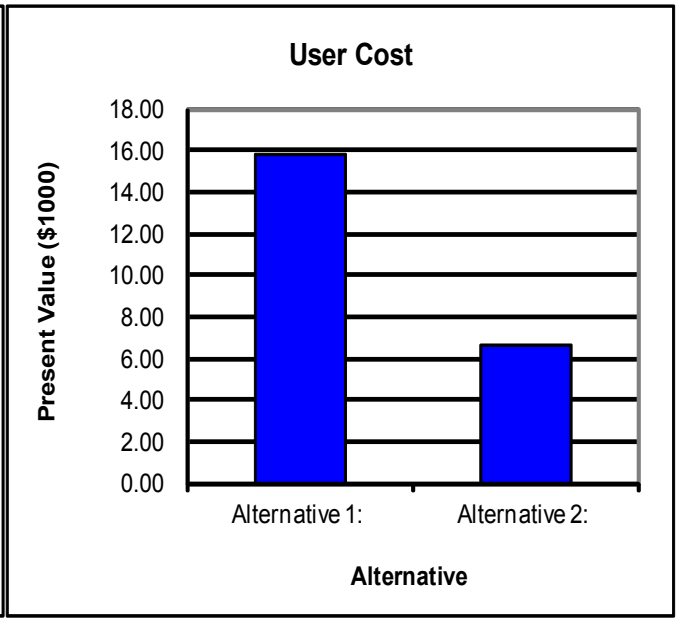
Rehabilitation #5	PCC Option	
Agency Construction Cost ($1000)	$692.10 **LCCATRIANG(616.921,692.1,767.279)**	
User Work Zone Costs ($1000)	$15.08	
Work Zone Duration (days)	21	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	18.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	4.501	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Rehabilitation #6	PCC Option	
Agency Construction Cost ($1000)	$692.10	**LCCATRIANG(616.921,692.1,767.279)**
User Work Zone Costs ($1000)	$15.08	
Work Zone Duration (days)	21	
No of Lanes Open in Each Direction During Work Zone	2	
Activity Service Life (years)	18.0	
Maintenance Frequency (years)	1	
Agency Maintenance Cost ($1000)	4.501	
Work Zone Length (miles)	1.00	
Work Zone Speed Limit (mph)	35	
Work Zone Capacity (vphpl)	3500	
Time of Day of Lane Closures (use whole numbers based on a 24-hour clock)		
Inbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6
Outbound	Start	End
First period of lane closure	21	6
Second period of lane closure	21	6
Third period of lane closure	21	6

Deterministic Results

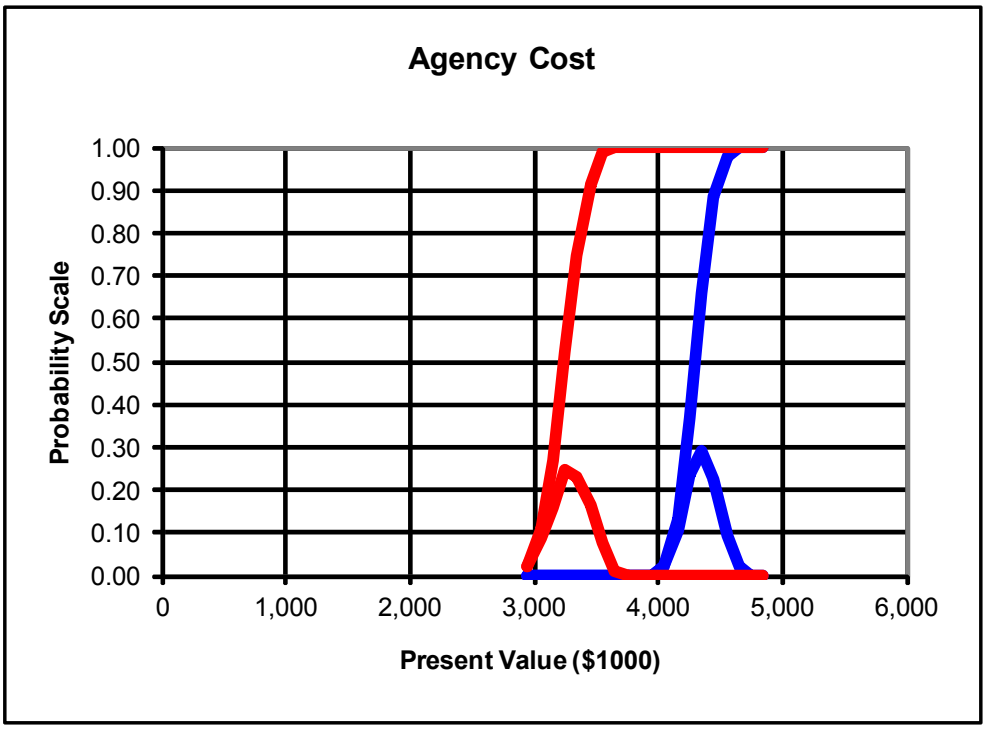
Total Cost	Alternative 1:		Alternative 2:	
	Agency Cost ($1000)	User Cost ($1000)	Agency Cost ($1000)	User Cost ($1000)
Undiscounted Sum	$5,705.15	$29.71	$3,628.82	$12.34
Present Value	$4,349.22	$15.84	$3,291.73	$6.64
EUAC	$197.39	$0.72	$149.40	$0.30

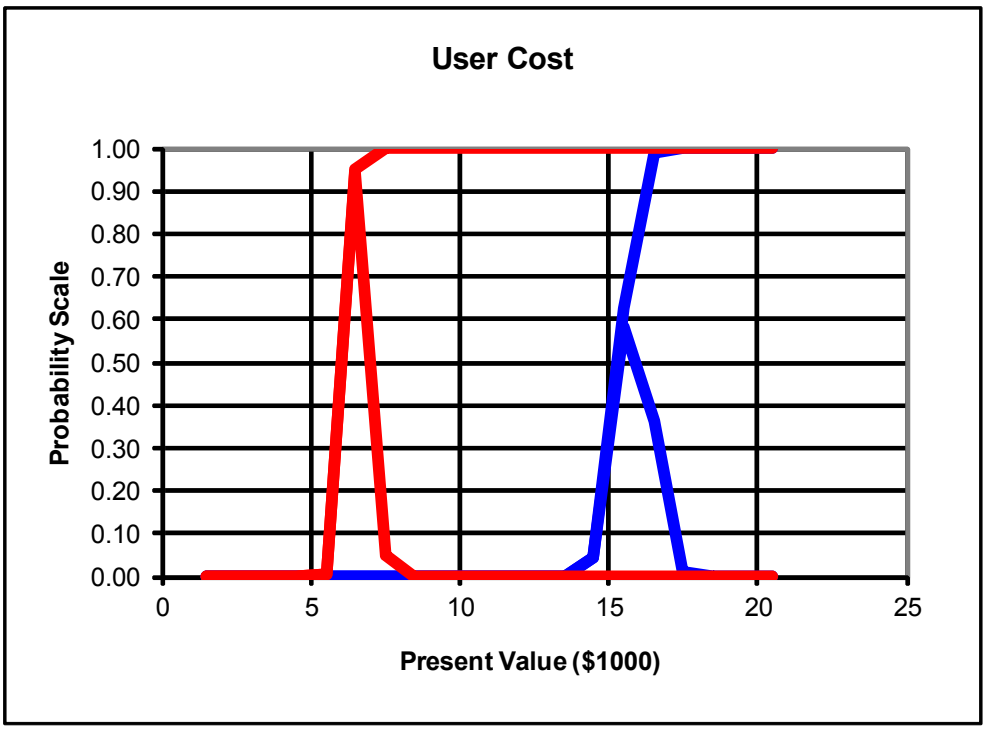




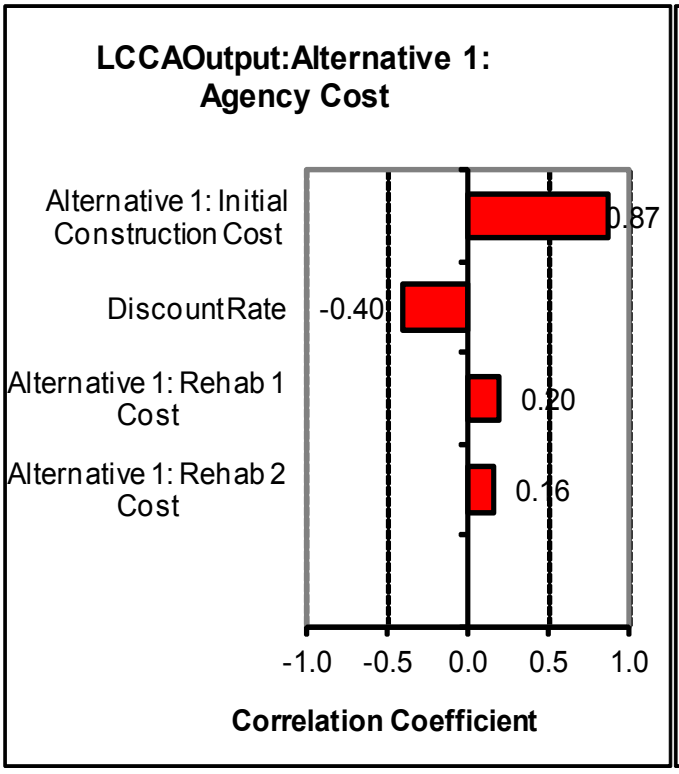
Probabilistic Results

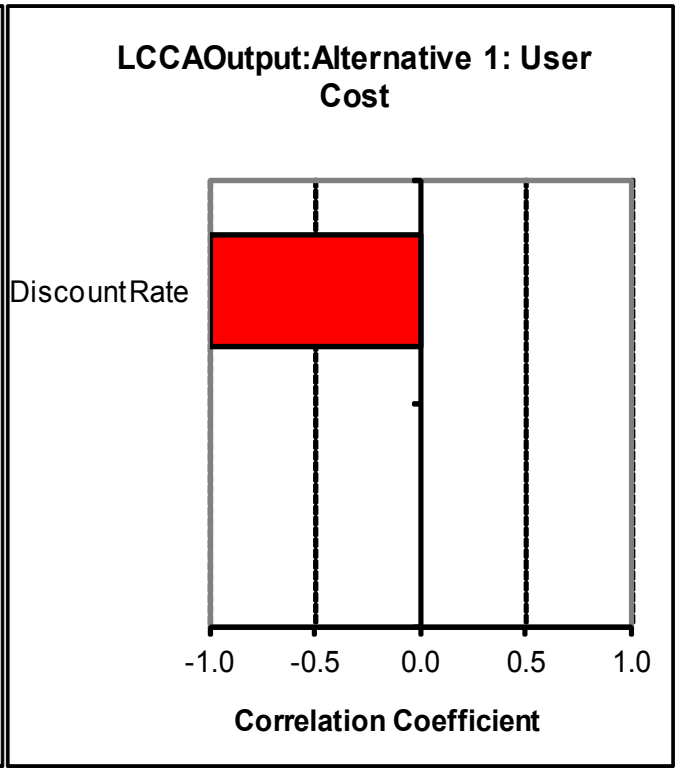
Total Cost (Present Value)	Alternative 1:		Alternative 2:	
	Agency Cost ($1000)	User Cost ($1000)	Agency Cost ($1000)	User Cost ($1000)
Mean	$4,345.75	$15.84	$3,293.08	$6.64
Standard Deviation	$126.31	$0.50	$146.70	$0.23
Minimum	$3,996.99	$14.26	$2,943.68	$5.90
Maximum	$4,756.52	$17.53	$3,652.25	$7.40

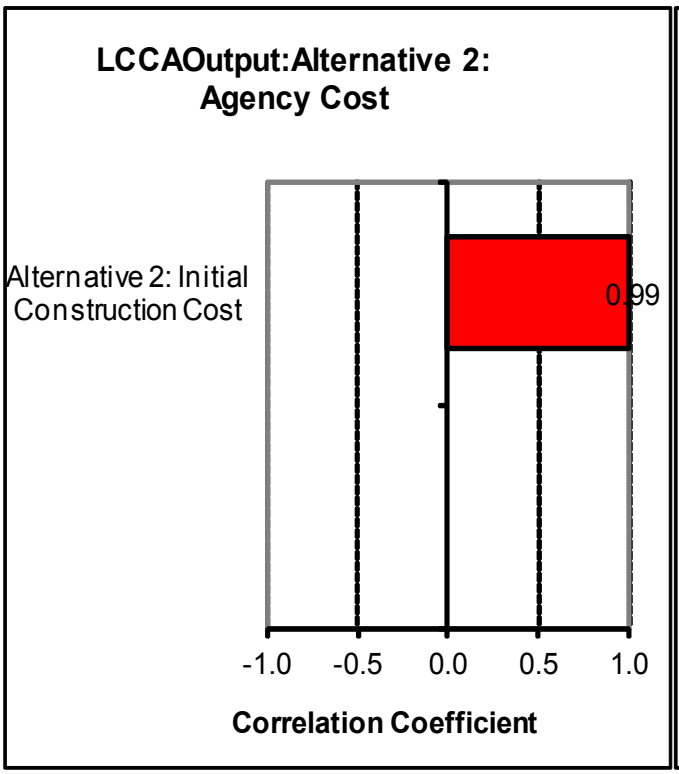


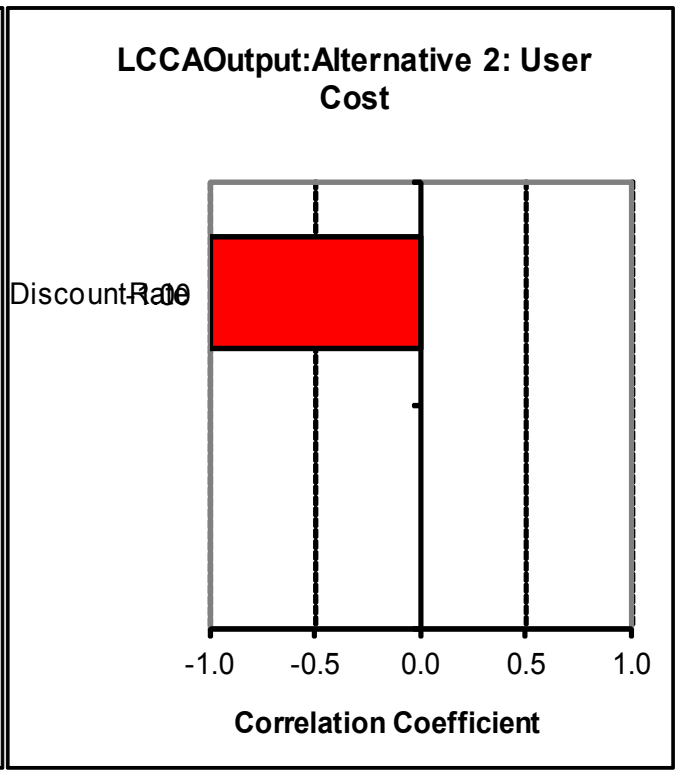


Tornado Graphs









Federal Boulevard, 7th to Holden Place
CC 0881-025 (18365)

Pavement Stabilization Parameter Table

DESIGN PARAMETER	MAINLINE FEDERAL BOULEVARD	FEDERAL BLVD. / 8TH AVENUE INTERSECTION
Design life (years):	**30**	**30**
18k ESAL:	**10,847,576**	**12,410,055**
% Trucks:	**40**	**40**
Initial Serviceability:	**4.5**	**4.5**
Terminal Serviceability:	**2.5**	**2.5**
% Reliability:	**95**	**95**
R-Value Design:	**5**	**5**
Soil Resilient Modulus (psi):	**3,025**	**3,025**
Modulus of Subgrade Reaction (psi/in)	**50**	**50**
Unconfined Compressive Strength (psf) :	**2,721**	**2,721**
Drainage Coefficient:	**1.0**	**1.0**
Pavement thickness (in):	**10.5”**	**11.0”**
Base thickness (in):	**6” ABC Class 6**	**6” ABC Class 6**
HMA Grading	-	-
Bottom Lift thicknesses (in):	-	-
HMA Grading:	-	-
Top Lift thickness (in):	-	-

Appendix E

Yeh and Associates, Inc.
Consulting Engineers & Scientists

September 6, 2012

Mr. Matthew A. Gilbert, P.E.
Tsiouvaras Simmons Holderness Inc.
5690 DTC Blvd., Suite 345W
Greenwood Village, CO 80111

Re: Final Geotechnical Engineering Report
8th Avenue Retaining Wall at Weir Gulch

Dear Mr. Gilbert,

Attached is the subject FINAL Report. Please contact the undersigned if you have any questions.

Respectfully Submitted,
Yeh and Associates, Inc.

Chen J P.E

I-Ping Chen P.E
Project Geotechnical Engineer

Yeh and Associates, Inc.
Consulting Engineers & Scientists

FINAL
Geotechnical Engineering Report
8th Avenue Retaining Wall at Weir Gulch
East of Federal Boulevard
Denver, Colorado

CCD Project Number: CC 0881-025

Project No. 211-117

September 6, 2012

Prepared for:

Tsioiuvaras Simmons Holderness, Inc.
5690 DTC Bloulevard, Level 3, Suite 345W
Greenwood Village, Colorado 80111

Prepared By:

Yeh and Associates, Inc.
5700 East Evans Avenue
Denver, Colorado 80222
Phone: 303-781-9590
Fax: 303-781-9583

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FIGURES

APPENDICES

1.0 PURPOSE AND SCOPE OF WORK

This report presents the results of Yeh and Associates geotechnical engineering investigation and evaluation for the proposed retaining wall and associated structures. The proposed retaining wall and structures will be located along the north side of 8th Avenue at Weir Gulch, east of Federal Boulevard (Figure 1, Site Vicinity Map).

The FINAL Pavement Design Report for this project was submitted on February 27, 2012.

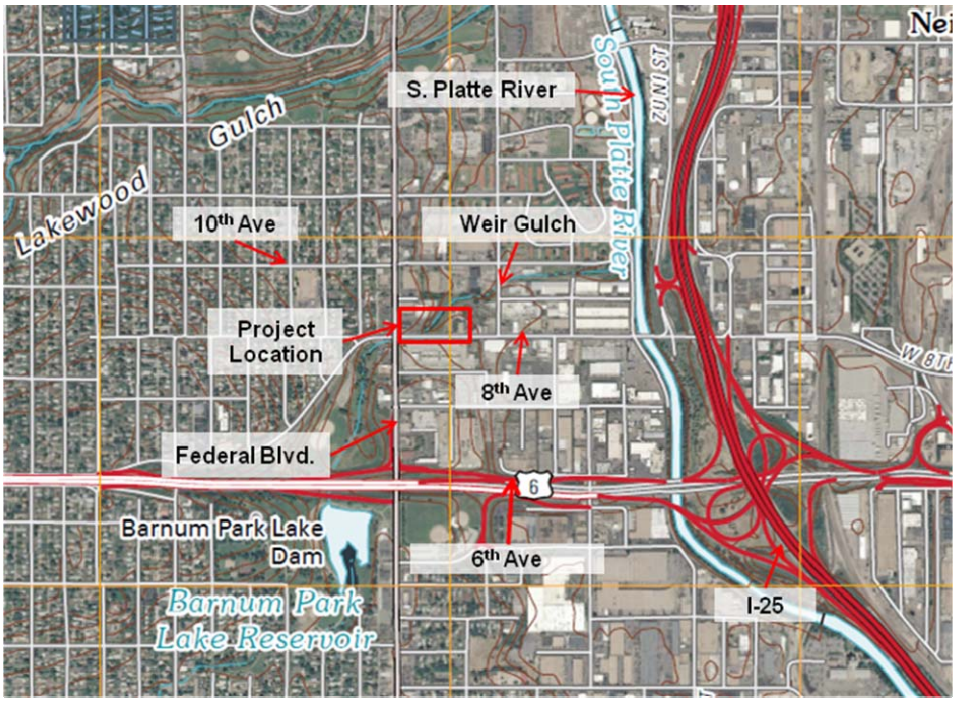


Figure 1, Site Vicinity Map (USGS Fort Logan, CO, 7.5 Minute Quadrangle, 2011)

The purpose of this investigation was to evaluate the geotechnical characteristics of the subsurface soils and bedrock at the location of the retaining wall to provide geotechnical engineering recommendations. The scope of the study included the following tasks:

- Conduct a subsurface investigation to obtain information on the subsurface materials.
- Perform laboratory testing on soil samples obtained during the subsurface investigation to determine the engineering characteristics of the on-site soils and bedrock.

- Prepare a report that summarizes our evaluation of the field and laboratory data and presents the results of our geotechnical engineering analyses and recommendations for the proposed structure.

2.0 PROPOSED CONSTRUCTION

A concrete retaining wall is proposed to be constructed along the north side of 8th Avenue to accommodate the widening of the sidewalk. The total length of the wall will be approximately 155 feet and the maximum wall height will be approximately 13 feet. A 34 inch high barrier will be constructed on top of the wall for the wall section along 8th Avenue. The wall section on top of the existing concrete box culvert (CBC) will be supported on a grade beam supported on drilled shafts that extend below the CBC. We understand that a possible second wall with a maximum height of 3.5 feet and a length of 24 feet may also to be constructed in front of the wall. The second wall may be a gabion, boulder or concrete wall.

3.0 REGIONAL GEOLOGY

The project area is located in the Denver Basin along the Front Range Urban corridor. A geologic map depicting the project area is shown on Figure 2. The Denver Basin is underlain by the Paleocene / upper Cretaceous age Denver and Arapahoe Formations. The Denver and Arapahoe Formations primarily include claystone and siltstone interbedded with sandstone, representative of shallow inland seaways, near shore, and terrestrial streambed conditions. These bedrock units are typically described as hard and indurated with a slight regional dip to the northeast.

The surficial soils at the proposed outfall location have been mapped as artificial fill (Af), Broadway Alluvium (Qb) of the Pleistocene age, and Piney Creek Alluvium (Qp), as shown on Figure 2. Artificial fills are mapped along the Weir Gulch. The alluvium soils are reported to be predominantly clean sands interlayered with varying amounts of silt and gravel. The mapped soils appear to be consistent with the subsurface conditions encountered in the borings drilled for this project.

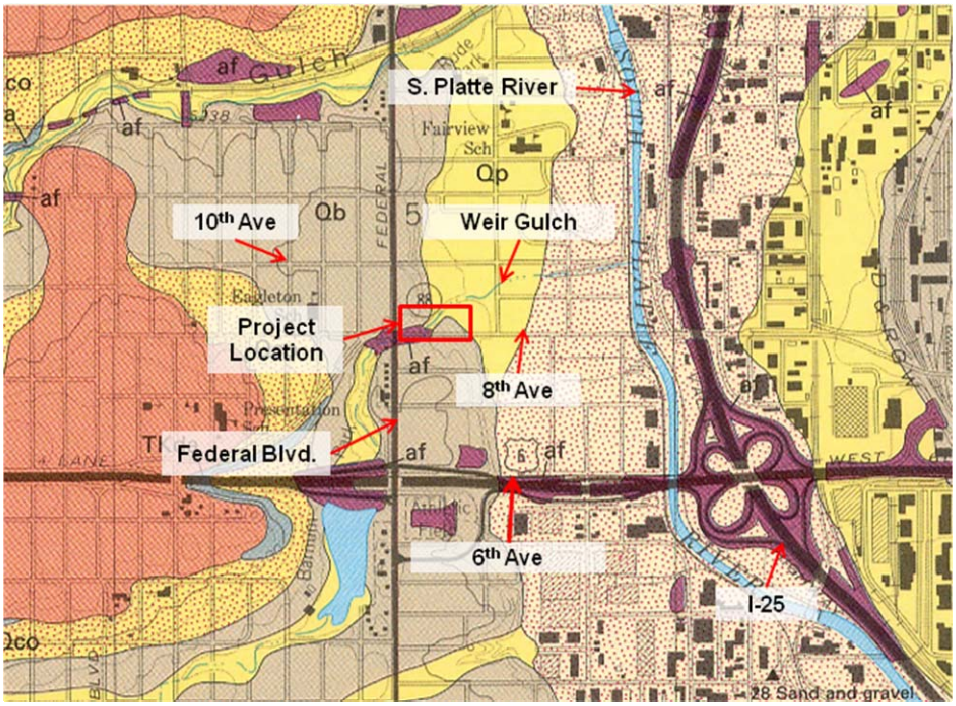


Figure 2, Geologic Map of Project Area (USGS, Robert M. Lindvall, 1978)

4.0 SUBSURFACE INVESTIGATION

Two borings (YA-RW1 and YA-RW2) were drilled at accessible locations along the proposed alignment of the retaining wall by Yeh and Associates in December of 2011. The boring locations are shown on Sheet A-1, Engineering Geology presented in Appendix A.

The borings were drilled by a Yeh and Associates subcontractor (Dakota Drilling) utilizing Dietrich D-50 and Boart Longyear 66 drill rigs. The borings were advanced using 8 inch outside diameter, hollow-stem augers. The subsurface conditions encountered in the borings were logged by a representative of Yeh and Associates. The boring logs are included in Appendix B, Legend and Boring Logs.

The borings were located in the field based on existing site features. The boring locations and ground surface elevations were estimated from the topographic files provided by Tsioiuvaras Simmons Holderness.

The recorded penetration resistance measurements were obtained by driving a modified California sampler or a split spoon typically at 5-foot intervals into the subsurface materials with a 140-pound hammer falling 30 inches. The modified California sampler is driven similar to ASTM D1586, “Standard Test Method for Standard Penetration Test (SPT) and Split Barrel

Sampling of Soils". The penetration resistance value (N-value) is a useful index to the consistency and relative density or hardness of the materials encountered.

Groundwater observations were made during the field investigation and are shown on the boring logs. Year-round groundwater conditions were not established as part of the field investigations. Groundwater conditions in the study area will likely vary considerably throughout the year. Variations can occur during different seasons, following precipitation events, after construction and site grading, and due to changes in surface and subsurface drainage characteristics of the surrounding area.

5.0 LABORATORY TESTING

Yeh and Associates performed laboratory testing on samples to determine the classification and engineering characteristics of the on-site soils and bedrock. Laboratory tests performed included natural density, natural moisture content, gradation analyses, Atterberg limits, swell-consolidation, pH, water soluble sulfates, water soluble chlorides and resistivity (see Appendix C, Laboratory Test Results).

6.0 SUBSURFACE CONDITIONS

Borings YA-RW1 and YA-RW2 were drilled in the paved areas on the north side of the 8th Avenue at Weir Gulch. The pavement consisted of 5 inches of concrete overlying 7 inches of base course in YA-RW1 and 8 inches of asphalt in YA-RW2. The subsurface soils encountered in YA-RW1 consisted of approximately 4 feet of fill comprised of stiff sandy clay and medium dense gravelly sand. The native soils below the fill consisted of layers of loose to medium dense clayey/silty sand and stiff to very stiff sandy clay. A very dense gravelly sand was encountered at a depth of approximately 39 feet below existing grade. The gravelly sand extended to the full depth of the exploration at 40.5 feet below the existing grade.

The subsurface soils encountered in YA-RW2 consisted of approximately 6 feet of fill described as medium dense clayey sand. The native soils below the fill generally consisted of medium dense clayey/silty sand and stiff to hard sandy clay. A medium dense to very dense gravelly sand was encountered at a depth of approximately 36 feet below existing grade. Very hard claystone bedrock was encountered at a depth of 65 feet below the existing grade and extended to the full depth of exploration at 75.2 feet below the existing grade.

Groundwater was encountered at depths of approximately 17 feet and 30 feet below the existing grade at the time of drilling in borings YA-RW1 and YA-RW2, respectively. An engineering geology sheet for the proposed project location is presented in Appendix A.

7.0 RETAINING WALL RECOMMENDATIONS

7.1 Drilled Shaft Recommendations

We understand that the wall section on top of the existing CBC will be supported on a grade beam and drilled shafts founded at the elevation below the bottom of the existing CBC. Specific design recommendations for the deep foundations subjected to axial and lateral loads are presented in the following subsections of this report. Generally, the soil and bedrock properties are estimated from uncorrected blow count data and material descriptions contained in the Yeh borings.

The recommendations contained herein generally comply with the AASHTO Load-Resistance Factor Design (LRFD) Bridge Design Specifications, 5th Edition.

1. We recommend minimum 18 inches diameter drilled shafts extending into the very dense gravelly sand layer, at about elevation 5192.
2. The recommended nominal side shear capacities, nominal end bearing capacities and resistance factor for drilled shaft founded in very dense gravelly sand are presented in Table 1. Resistance factors of per AASHTO Table 10.5.5.2.4-1 should be applied to the nominal bearing capacity values. The upper 3 feet of soils should not be used for capacity estimates due to potential of possible future disturbance. Adjustments to the load and/or resistance factors may be required per AASHTO 10.5.5.2.4, if the drilled shafts are considered non-redundant.

Table 1, Recommended Nominal Bearing Capacities

Side Shear Capacity		End Bearing Capacity	
Nominal Side Shear Capacity (ksf)	**Resistance Factor**	**Nominal End Bearing Capacity (ksf)**	**Resistance Factor**
0.6	0.55	20	0.50

3. Based on AASHTO Figure 10.8.2.2.2-4 and the results of our field exploration, laboratory testing and our experience with similar properly constructed drilled shaft foundations, we estimate individual shaft settlement will be less than ½ inch when designed according to the criteria presented in this report.
4. To account for axial group effects, the minimum spacing requirements between drilled shafts should be three diameters from center-to-center.
5. The drilled shaft excavation should be carefully observed by a qualified representative of a registered Professional Engineer to verify the design depth and the bearing materials.
6. Groundwater and potentially caving soils may be encountered during drilling depending on the time of year. The Contractor shall be prepared to construct the drilled shaft using means and methods that maintain a stable hole in silty sand soils that are below the groundwater elevation such as using temporary steel casing or other methods with the Engineer's approval.
7. The drilled shaft excavation should be carefully observed by a qualified representative of a registered Professional Engineer to verify the design depth and the bearing materials.

The input parameters provided in Table 2 are recommended for use with the computer program LPILE to develop the soil models used to determine the drilled shafts response to lateral loading. The table describes the values associated with the soil types encountered in the borings. Individual soil layers and their extent can be averaged or distinguished by referring to the boring logs. The soils and/or bedrock materials prone to future disturbance, such as from scour, utility excavations or frost heave, should be neglected in the lateral pile analyses.

For consideration of group effects, AASHTO Section 10.7.2.4 recommends the use of p-multipliers based on orientation of load and spacing between deep foundation elements (applies to drilled shafts) or by considering the extent of overlapping shear zones using strain wedge theory.

Table 2, LPILE Parameters

Soil Type	LPILE Soil Criteria	Effective Unit Weight (pcf)	Friction Angle, (deg.)	Undrained Cohesion, c (psf)	Strain Factor, ε50	p-y Modulus, k (pci)
Class 1 Structure Backfill	Sand (Reese)	135	37	---	----	225
Native Clayey and Silty Sand(above G.W.T.[1])	Sand (Reese)	115	28	----	----	90
Native Clayey and Silty Sand (submerged)	Sand (Reese)	55	28	----	----	60
Native Sandy Clay (above G.W.T.[1])	Stiff Clay w/o Free Water (Welch & Reese)	110	---	1000	0.007	---
Native Sandy Clay (submerged)	Stiff Clay with Free Water (Welch & Reese)	50	---	1000	0.007	500
Native Sand and Gravel (above G.W.T.[1])	Sand (Reese)	120	33	----	----	90
Native Sand and Gravel (submerged)	Sand (Reese)	60	33	----	----	60
Bedrock (G.W.T.[1] perched on Bedrock)	Stiff Clay w/o Free Water (Welch & Reese)	130	----	10000	0.004	---

[1] Groundwater Table

7.2 Cast-in-place (CIP) Retaining Wall Recommendations

A cast-in-place (CIP) retaining wall is a suitable option for construction along the north side of the street for the proposed sidewalk due to the specific site constraints of limited space and floodplain. At the time of this report, the final grading and as-built information on the gabion wall along the gulch were not provided. Our recommendations are based on our experience

and assumptions with similar projects and the provided information. The recommendations presented herein should be reviewed and further analyses on bearing capacity and global stability should be performed during final design of the retaining wall.

7.2.1 Global Stability

It is our understanding that the CIP wall will be design based on the current American Association of State Highway and Transportation Officials, 2010, AASHTO LRFD Bridge Design Specifications. The language provided in the AASHTO LRFD for overall stability indicates a resistance factor of 0.65 which equates to a factor of safety of 1.5. However, the current state of practice has indicated some interpretation that the retaining wall should satisfy an overall global stability resistance factor of 0.75 under service load conditions. This equates to a factor of safety of 1.3. Historically, several agencies in Colorado have designed slopes and retaining walls with the overall global stability factor of safety of 1.3. We suggest that the design global factor of safety be discussed with the City and County of Denver as there may be additional costs associated with achieving higher factors of safety without comparable increases in public safety.

Global stability analyses of the slope cross-section were performed for both existing and construction conditions and are presented in Appendix D. The global stability analyses are based on the wall plan and profile projected onto the cross-sectional view and our assumptions and interpretations of the conceptual layout plan and existing channel conditions. The global stability analyses, using the software GSTABL7 (Version 2), indicates a factor of safety 1.5 for global stability for the CIP wall based on the conceptual design and a 4 foot embedment of the wall. The deeper wall embedment is recommended for both stability and for bearing capacity.

The design widths of the CIP concrete spread footing should be checked for overall global stability. We estimate CIP concrete spread footing widths needed to satisfy overall global stability may vary from 70 to 95 percent of the design wall height (top-of-leveling pad to top-of-wall) depending on the toe slope angle and live loading near back of wall. A global stability check of critical cross-sections depicting the wall systems and final grading should be completed during final wall design.

7.2.2 Bearing Capacity

It is recommended that the foundation subgrade be visually inspected. All soft subgrade soils observed in the subgrade should be over-excavated to a minimum depth of 2 feet, and

replaced, with Class 1 Structure Backfill compacted to 95 percent of modified Proctor density (AASHTO T-180) in conformance with Section 206 (CDOT, 2011).

Shallow foundations for retaining walls shall be embedded a minimum of 4 feet below final grade for frost protection, toe slope conditions and confinement. The final embedment grade in front of the wall should be maintained throughout the life of the wall. Based on our analyses, we recommend a nominal bearing capacity of 6,000 psf on average for the retaining wall foundations having a minimum width of 8 feet. A 30 percent increase of the load due to the lateral earth pressure may be added onto the edge of the footing. A resistance factor of 0.55 may be used.

7.2.3 Estimated Settlement

Based on our geotechnical engineering analyses, we estimate a maximum total settlement of the CIP wall on the order of 1.5 inches. It is anticipated that majority of the settlement will occur during construction. The retaining wall design should consider the potential differential between the CIP section of the wall and the grade beam supported wall over the CBC.

7.2.4 Lateral Earth Pressure Recommendations

We recommend that either CDOT Class 1 Structure Backfill or granular fill (AASHTO classifications A-1, A-2-4 and/or A-3) be placed and compacted to 95 percent of the maximum dry density determined by the modified Proctor test, in accordance with Section 206 (CDOT, 2011) for any backfill placed adjacent to the CIP retaining wall. An experienced geotechnical engineer should review the soil types proposed to be used as backfill in the vicinity of the retaining walls and determine whether the design assumptions are valid.

Lateral wall movement or rotation of at least 0.5 percent of the wall height is typically required to develop the full active pressure condition. If the estimated wall movement is less than this amount, an at-rest soil pressure should be used in design.

Earth pressure loading within and along the back of wall is controlled by the structural backfill. An effective angle of internal friction of 34 degrees, an active earth pressure coefficient of 0.28 (for a horizontal backslope), an in-situ (at rest) earth pressure coefficient of 0.44 (for a horizontal backslope), and a unit weight of 130 pounds per cubic foot (pcf) for compacted CDOT Class 1 Structure Backfill or granular fill may be used for determining the appropriate earth pressure loading and loading from other equivalent surcharges such as traffic live load, etc. If

the structure backfill materials vary, additional laboratory tests shall be provided to verify these material properties. In the event where the earth pressure is controlled by the on-site material, an effective angle of internal friction of 30 degrees, an active earth pressure coefficient of 0.33 (for a horizontal backslope), an in-situ (at rest) earth pressure coefficient of 0.5 (for a horizontal backslope), and a unit weight of 115 pounds per cubic foot (pcf) may be used for determining the earth pressure loading induced by the on-site materials.

The lateral earth pressure coefficients may be determined from AASHTO Article 3.11.5.3 for specific wall backslopes and interface friction values. In all cases, the calculated active earth pressure used for design should not be less than an equivalent fluid density of 35 pcf. The lateral earth pressure induced by additional surcharge loads above the top of the walls should also be considered in design.

These earth pressure values are valid with the following conditions:

1. For uneven or varying backslopes, the surcharge effects of the backslope should be considered for a minimum of 2 times the exposed wall height or 10 feet, whichever is greater.
2. Hydrostatic (seepage) pressures should not be allowed to develop in the active soil wedge. We recommend that the wall designer include appropriate drainage elements that are typically installed near the back and bottom of retaining walls, such as geocomposite strip drains, perforated pipes, filter materials and/or weep holes to control surface and ground water flows.

7.2.5 Sliding

Resistance to sliding at the bottom of the retaining wall can be calculated based on a coefficient of friction at the interface between the CIP concrete and the proof-rolled subgrade soil and passive soil pressure developed against the side of the foundation and/or foundation CIP shear key.

For sliding resistance, we recommend that a nominal coefficient of friction of 0.34 and a resistance factor of 0.85 be used in design. The passive pressure against the sides of the CIP spread foundation and/or concrete shear key can only be used if long-term protection from disturbance, such as frost heave, excavation, etc. is assured. The passive resistance recommendation presented below was calculated from Figure 3.11.5.4-2, AASHTO, where a portion of the slip surface is modeled as a log-spiral, the backslope is horizontal and the passive soil/concrete interface friction is equal to 60 percent of the soil's friction angle. For the on-site

native sand and clay soils, we recommend a nominal equivalent fluid pressure of 450 pcf and a resistance factor of 0.5 for passive earth pressure, with 4 feet of embedment maintained in all time.

In addition, the retaining walls should be designed to limit the resultant, eccentric unfactored force applied to the foundation soil to occur within the central half of the spread foundation base.

8.0 SITE GRADING

7.3 Excavations and Fill Slopes

All site excavation and embankment grading should conform to all applicable governing standards and regulations including but not limited to CDOT technical specifications and OSHA worker safety regulations. Cut slopes should be protected from surface water runoff and stream scour to prevent erosion and slope failure. Good surface drainage should be provided around all permanent cuts and fills to direct surface runoff away from the slope faces. Fill slopes, cut slopes, and other stripped areas should be protected against erosion by re-vegetation or other methods.

Based on the field exploration and observations, excavations for the retaining wall may encounter groundwater. The risk of slope instability is significantly increased with groundwater seepage. Some areas may require temporary dewatering or other mitigation measures, including foundation stabilization to facilitate wall construction.

Permanent un-retained cut and fill slopes in the project area should not be steeper than 2.5(H):1(V). Surface water runoff should be directed away from the top of the slope and should not be allowed to pond at the top or bottom of the slope.

Prior to placing embankment fill, all vegetation or soft, organic topsoil should be stripped and the top 6 inches of exposed subgrade should be scarified and recompacted in accordance with Section 203.07 of the CDOT Standard Specifications.

The required percent of relative compaction and moisture content for the various subgrade soils and embankment materials are presented in Section 203.07 of the CDOT Standard Specifications.

7.4 Drainage Considerations

Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Proper design of drainage should include prevention of ponding of water on or immediately adjacent to the structures. Surface features that could retain water in areas adjacent to the structures should be sealed or eliminated. Concentrated runoff should be avoided in areas susceptible to erosion and slope instability. Slopes and other stripped areas should be protected against erosion by re-vegetation or other method.

The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of pavement. All landscape sprinkler heads adjacent to pavement areas should be frequently checked for leaks and maintained in good working order. Over-spray from sprinklers should be minimized.

9.0 OTHER DESIGN CONSIDERATIONS

9.1 Water-Soluble Sulfates

The concentration of water-soluble sulfates measured in a sample obtained from the exploratory borings was 0.058 percent. This concentration of water-soluble sulfates represents a Class 0 degree of sulfate attack on concrete exposed to soils in the project area as presented in Table 601-2 of Sections 601, Structural Concrete of the CDOT Standard Specifications for Road and Bridge Construction, 2011. The degree of attack on concrete is based on a range of Class 0 (negligible) to Class 3 (very severe) as presented in the CDOT Standard Specifications.

9.2 Corrosion

Test results for acidity (pH), water soluble chlorides and electric resistivity of the soil sample indicated the following:

- pH: 7.3
- Water soluble chlorides: 0.0431 percent
- Resistivity: 683 ohm-cms

The pH test result indicates the subsurface material is slightly basic. The concentrations of water soluble chloride combined with the sulfate concentration generally correspond to a Corrosion Resistance Level 1 (CR1), as presented in CDOT Pipe Material Selection Policy, dated May 27, 2010. The resistivity levels indicate the subsurface material is aggressive toward corrosion of buried metals.

9.3 Seismic Considerations

Based on the results of the subsurface investigation and AASHTO Specifications for LRFD Design Table 3.10.3.1-1, the project area is Site Class D. AASHTO Table 3.10.5-1 classifies the seismic zone as Zone 1.

10.0 LIMITATIONS

This report was prepared for the exclusive use of Tsioiuvaras Simmons Holderness, Inc. for specific use on the Federal Boulevard Reconstruction project at 8th Avenue and Weir Gulch. The work was performed in accordance with generally accepted geotechnical engineering practices in this area. No warranty, expressed or implied, is made. The conclusions and recommendations made are based upon the data obtained and described in this report, including the subsurface investigation. This investigation indicates the subsurface conditions only at the specific locations and to the depths specified when the data was obtained. This data may not necessarily reflect variations in the subsurface conditions and water levels occurring at other locations. Also variations in the data may occur with the passage of time. If variations in the subsurface conditions from those described in this report are discovered, the recommendations contained in this report must be reevaluated. If during construction, fill, soil, rock or water conditions appear to be different from those described herein, this office should be advised at once so reevaluation of the recommendations may be made.

Respectfully submitted,
Yeh and Associates, Inc.

COLORADO LICENSED
I PING CHEN
44801
9-6-2012
PROFESSIONAL ENGINEER

I-Ping Chen, P.E.
Project Geotechnical Engineer

Michael L. Kiefer, P.E.
Senior Project Manager

Reviewed By:

Jere A. Strickland, P.E.
Senior Project Manager

11.0 REFERENCES

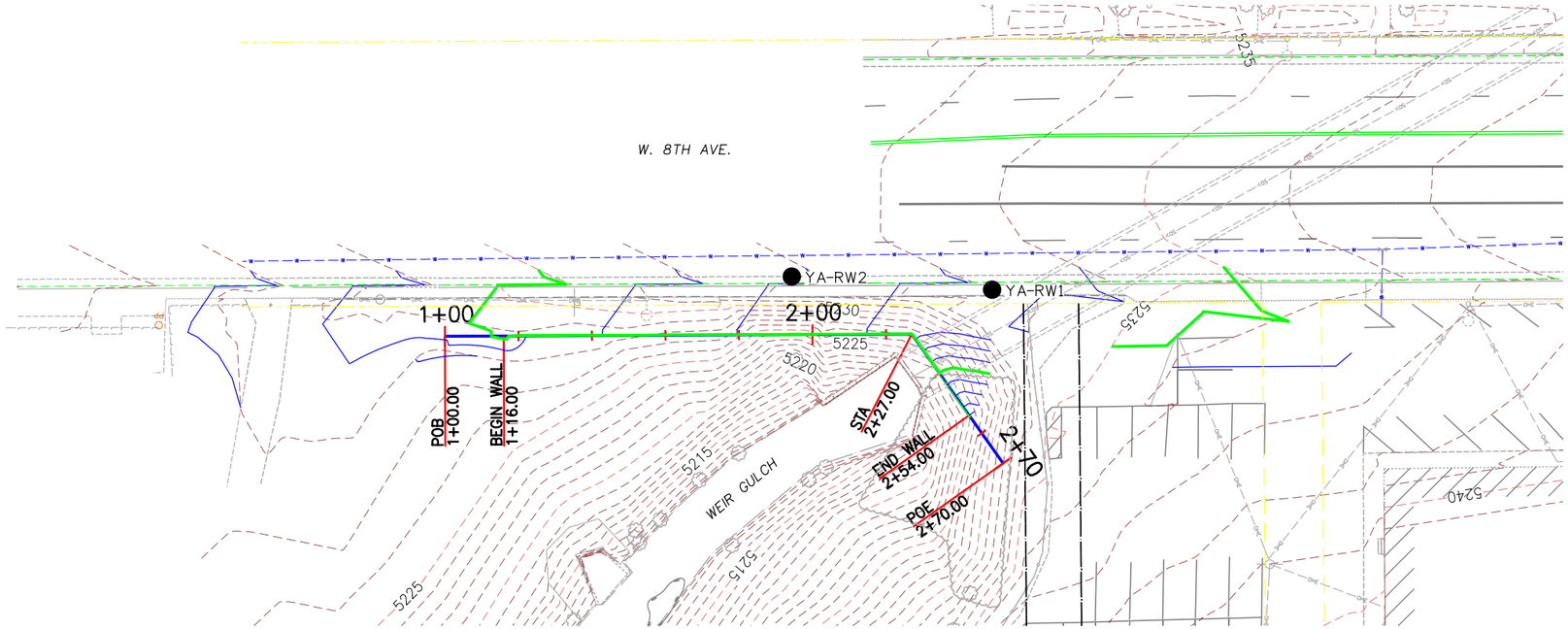
American Association of State Highway and Transportation Officials, 2010, AASHTO LRFD Bridge Design Specifications, Customary U.S. Units, 5th Edition: Washington DC

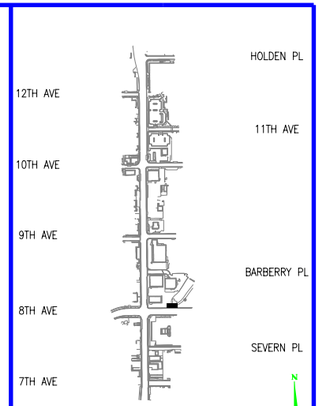
Colorado Department of Transportation, CDOT Pipe Material Selection Policy, dated May 27, 2010

Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction (2011) and related Specifications

Robert, M. Lindvall, 1978, Geologic map of the Fort Logan quadrangle, Jefferson, Denver and Arapahoe Counties, Colorado, U.S. Geological Survey, Map GQ 1427, scale 1:24000

Appendix A, Engineering Geology





N

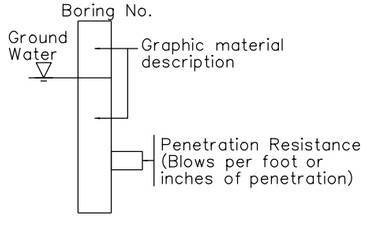
Scale in Feet

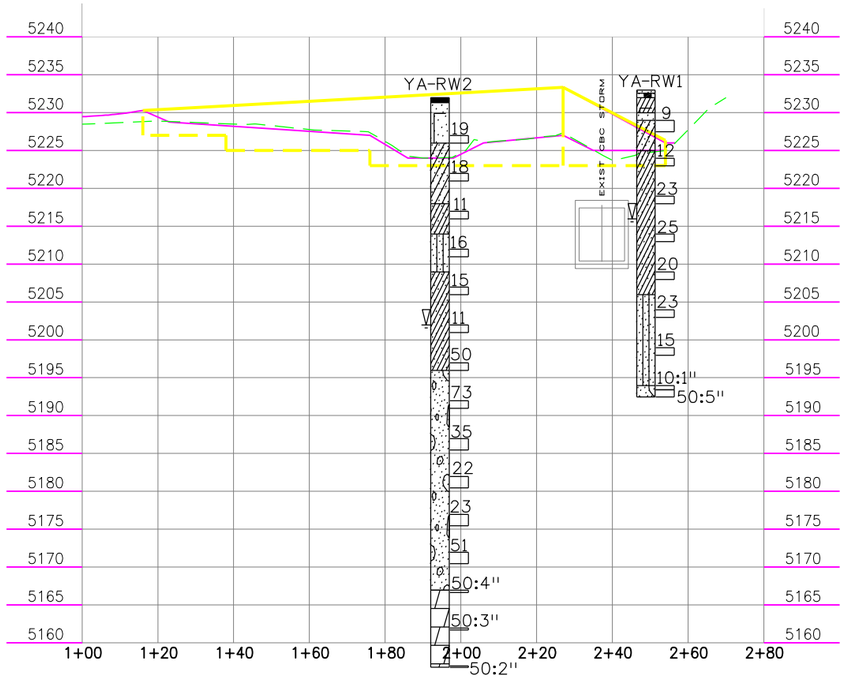
● BORING LOCATION

LEGEND

- Concrete
- USCS Well-graded Gravel
- Fill with Clay as major soil
- Fill with Sand as major soil
- USCS Clayey Sand
- USCS Low Plasticity Sandy Clay
- USCS Silty Sand
- USCS Poorly-graded Gravelly Sand
- Asphalt
- Claystone

TYPICAL TEST HOLE LOG





NOTE:
BORINGS WERE NOT SURVEYED, LOCATIONS ARE APPROXIMATE. ELEVATIONS TAKEN FROM PROVIDED TOPOGRAPHIC DGN.

Yeh and Associates, Inc.
Consulting Engineers & Scientists

Last Modification Date:	Init.:
Drawing File Name: 1102188-8th Ave Wall - YA Eng Geo.dgn	
Horizontal Scale: 1:40	Vert. Scale: As Noted

Sheet Revisions

Date:	Comments	Init.

City and County of Denver
Department of Public Works
Engineering Division
201 W. Colfax, Dept 506
Denver, CO. 80202

Colorado Department of Transportation
2000 South Holly Street
Denver, CO 80222
Phone: 303-757-9914
FAX: 303-757-9053
Region 6 XXX

As Constructed

No Revisions:	
Revised:	
Void:	

FEDERAL BLVD. RECON. - 5TH AVE. TO HOWARD PLACE
8TH AVE RETAINING WALL AT WEIR GULCH
ENGINEERING GEOLOGY

Designer:	M. Kiefer	Structure Numbers	
Detailer:	M. Walz		
Sheet Subset:		Subset Sheets:	of

Project No./Code
CC 0881-025
SA 18365
CE02011

Sheet Number A-1

Mike Walz
9/6/2012
2:43:02 PM
$FILEPATH$

Appendix B, Legend and Boring Logs

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Legend for Symbols Used on Borehole Logs

Sample Types

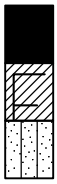

Auger Cuttings


Grab Sample


Modified California Sampler


Split Spoon

Soil Lithology


Asphalt

Fill with Clay as major soil

USCS Silty Sand


CLAYSTONE

Fill with Sand as major soil

USCS Poorly-graded Gravelly Sand


USCS Low Plasticity Sandy Clay

USCS Well-graded Gravel


Concrete

USCS Clayey Sand

Lab Test Abbreviations

MC-Moisture Content
DD-Dry Density
#200-Percent Passing #200 Sieve
LL-Liquid Limit
PL-Plastic Limit
PI-Plastic Index
S-Sulphate Content
S/C-Swell/Consolidation
UCCS-Unconfined Compressive Strength
Re-Resistivity
PtL-Point Load Test
AASHTO-AASHTO Classification
USCS-USCS Classification
Cl-Chloride

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW1**
Sheet 1 of 2

Boring Began: 12/7/2011
Drilling Method: Hollow-Stem Auger (8" O.D.)
Drill: Boart Longyear 66
Driller: Dakota Drilling
Logged By: K. Asay
Final By: I. Chen
Inclination: Vertical

Completed: 12/7/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.5 ft
Ground Elevation: 5233 (Estimated)
Location: Locations are taken from Topographic Dgn
Coordinates: N: E:

Ground Water Notes:

Depth	▽ 17.0 ft	-	-	-
Date	12/7/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.4 ft. CONCRETE, 5 inches.	
								0.4 - 1.0 ft. ROAD BASE, 7 inches.	
								1.0 - 3.0 ft. sandy CLAY FILL,with some silt, black, stiff.	
								3.0 - 4.0 ft. gravelly SAND FILL, black, medium dense.	
	5				3/4/5	9		**4.0 - 8.0 ft. clayey SAND** with some gravel, brown, loose.	MC= 23 % #200= 40 % LL= 48 PL= 19 PI= 29 AASHTO: A-7-6 (6) USCS: SC
								8.0 - 27.0 ft. sandy CLAY, brown, stiff to very stiff, rust stains.	
	10				5/7	12			MC= 30.1 % DD= 91.1 pcf S/C= -0.2 %
	15				10/13	23			MC= 26 % DD= 97.4 pcf #200= 79 % LL= 61 PL= 20 PI= 41 AASHTO: A-7-6 (33) USCS: CH
	20				10/15	25			MC= 42.7 % DD= 77.5 pcf
	25				8/12	20			MC= 30.9 % DD= 90.7 pcf
								27.0 - 39.0 ft. silty SAND, brown, medium dense.	
	30				7/16	23			MC= 27.1 % DD= 96.5 pcf #200= 45 % LL= NV PL= NP PI= NP AASHTO: A - 4 (0) USCS: SM
					7/8	15			MC= 39 %

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW1**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
									DD= 80.6 pcf
					50:7"	50:7"		**39.0 - 40.5 ft. gravelly SAND** with silt, brown, very dense.	MC= 12.9 %
	40				80:11"	80:11"			
								Bottom of Hole at 40.5 ft.	MC= 7.1 % #200= 6 % LL= NV PL= NP PI= NP AASHTO: A-1-b (0) USCS: SP - SM
	45								
	50								
	55								
	60								
	65								
	70								
	75								

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW2**
Sheet 1 of 2

Boring Began: 12/2/2011
Drilling Method: Hollow-Stem Auger (8" O.D.)
Drill: Dietrich D-50 Rubber Track
Driller: Dakota Drilling
Logged By: B. Johnson
Final By: I. Chen
Inclination: Vertical

Completed: 12/2/2011
Drill Bit:
Casing:
Weather:

Total Depth: 75.2 ft
Ground Elevation: 5232 (Estimated)
Location: Locations are taken from Topographic Dgn
Coordinates: N: E:

Ground Water Notes:

Depth	▽ 30.0 ft	-	-	-
Date	12/2/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.7 ft. ASPHALT, 8 inches.	
								0.7 - 6.0 ft. clayey SAND FILL, with some gravel, dark brown, medium dense.	MC= 14.1 % #200= 33 % LL= 35 PL= 17 PI= 18 AASHTO: A-2-6 (0) USCS: SC pH= 7.3 S= 0.058 % Re= 683 ohms-cm Cl= 0.0431 %
	5				11/8	19			
								6.0 - 14.0 ft. clayey SAND, brown, medium dense.	
	10				7/11	18			MC= 24.7 % DD= 92.1 pcf
								14.0 - 18.0 ft. sandy CLAY, brown, stiff.	
	15				5/6	11			MC= 25.3 % DD= 82.8 pcf
								18.0 - 23.0 ft. silty SAND, brown, medium dense.	
	20				7/9	16			MC= 17.3 % DD= 87.7 pcf #200= 41 % LL= NV PL= NP PI= NP AASHTO: A - 4 (0) USCS: SM
								23.0 - 36.0 ft. sandy CLAY, brown, stiff to hard.	
	25				7/8	15			MC= 28.9 % DD= 86.1 pcf #200= 70 % LL= 53 PL= 19 PI= 34 AASHTO: A-7-6 (22) USCS: CH
▽	30				5/6	11			MC= 42.7 % DD= 78.2 pcf #200= 89 % LL= 55 PL= 21 PI= 34 AASHTO: A-7-6 (33) USCS: CH

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW2**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
					7/43	50			
								36.0 - 65.0 ft. gravelly SAND with some silt, brown, medium dense to very dense.	
	40				23/50	73			MC= 11.9 % #200= 4 % LL= NV PL= NP PI= NP AASHTO: A-1-b (0) USCS: SP
	45				16/17/18	35			MC= 11.2 %
	50				9/10/12	22			
	55				10/11/12	23			MC= 11.3 %
	60				16/23/28	51			
	65				50:4"	50:4"		**65.0 - 75.2 ft. CLAYSTONE**, gray, very hard.	MC= 17.4 %
	70				50:3"	50:3"			
	75				50:2"	50:2"		Bottom of Hole at 75.2 ft.	

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

Appendix C, Laboratory Test Results

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 211-117 Project Name: 8th Ave. Retaining Wall at Weir Gulch Date: 12/28/2011

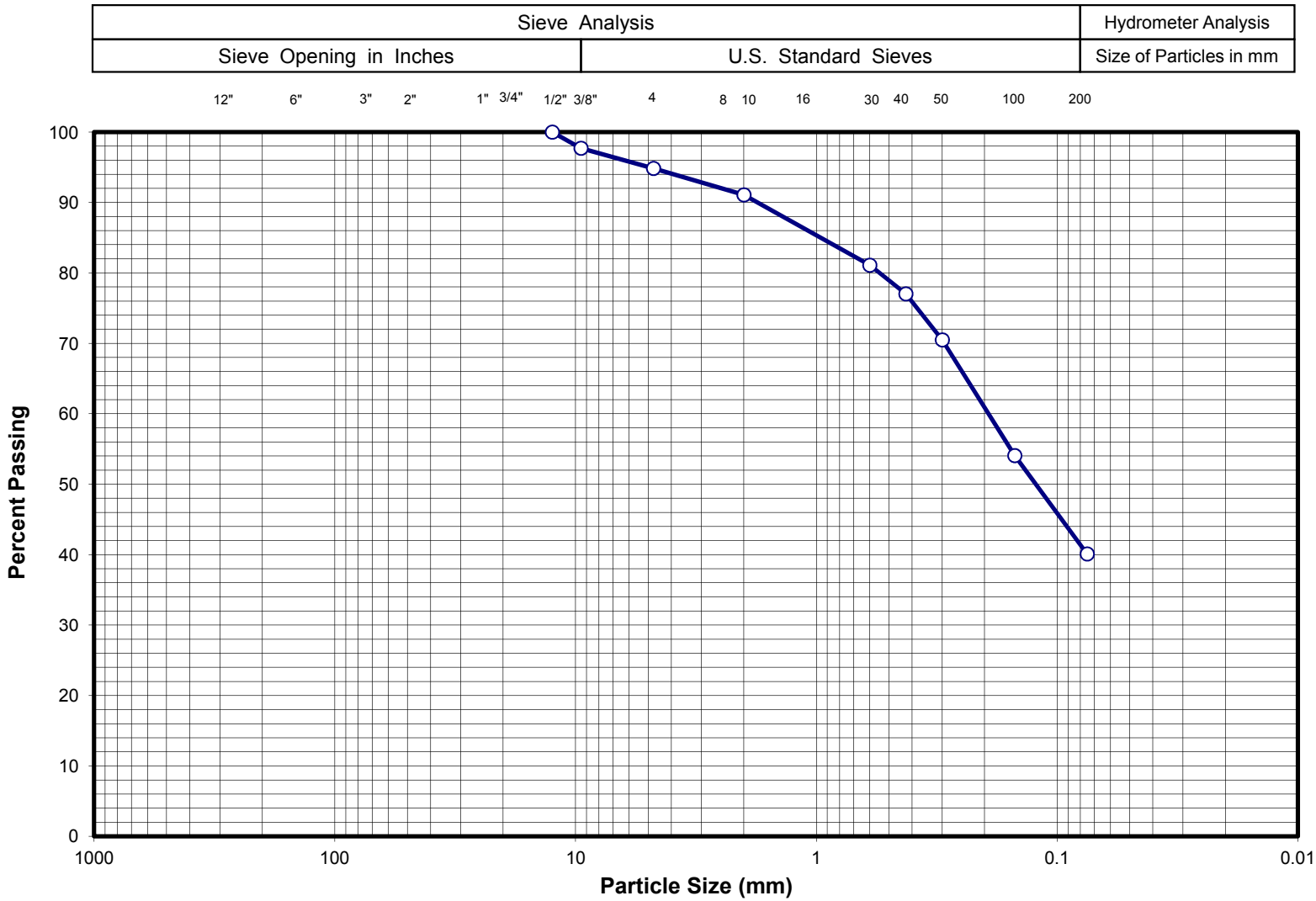
Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg			pH	Water Soluble Sulfate %	Resistivity ohm.cm	Chloride %	% Swell (+) / Consoli-dation (-)	CLASSIFICATION	
Boring NO.	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI						AASHTO	USCS
YA-RW1	4	CA	23.0	–	5	55	40	48	19	29	–	–	–	–	–	A-7-6 (6)	SC
YA-RW1	9	CA	30.1	91.1	–	–	–	–	–	–	–	–	–	–	-0.2	–	–
YA-RW1	14	CA	26.0	97.4	–	–	79	61	20	41	–	–	–	–	–	A-7-6 (33)	CH
YA-RW1	19	CA	42.7	77.5	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW1	24	CA	30.9	90.7	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW1	29	CA	27.1	96.5	0	55	45	NV	NP	NP	–	–	–	–	–	A - 4 (0)	SM
YA-RW1	34	CA	39.0	80.6	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW1	39	CA	12.9	–	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW1	41	CA	7.1	–	15	79	6	NV	NP	NP	–	–	–	–	–	A-1-b (0)	SP - SM
YA-RW2	0-5	Bulk	14.1	–	6	61	33	35	17	18	–	–	–	–	–	A-2-6 (0)	SC
YA-RW2	5	CA	–	–	–	–	–	–	–	–	7.3	0.058	683	0.0431	–	–	–
YA-RW2	10	CA	24.7	92.1	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW2	15	CA	25.3	82.8	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW2	20	CA	17.3	87.7	0	59	41	NV	NP	NP	–	–	–	–	–	A - 4 (0)	SM
YA-RW2	25	CA	28.9	86.1	–	–	70	53	19	34	–	–	–	–	–	A-7-6 (22)	CH
YA-RW2	30	CA	42.7	78.2	–	–	89	55	21	34	–	–	–	–	–	A-7-6 (33)	CH

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 211-117 Project Name: 8th Ave. Retaining Wall at Weir Gulch Date: 12/28/2011

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg			pH	Water Soluble Sulfate %	Resistivity ohm.cm	Chloride %	% Swell (+) / Consoli-dation (-)	CLASSIFICATION	
Boring NO.	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI						AASHTO	USCS
YA-RW2	40	SS	11.9	–	15	81	4	NV	NP	NP	–	–	–	–	–	A-1-b (0)	SP
YA-RW2	45	SS	11.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW2	55	SS	11.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
YA-RW2	65	SS	17.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	100
⅜"	98
#4	95
#10	91
#40	77
#200	40

Gravel (%)	5	LL	48	Project Name:	8th Ave. Retaining Wall at Weir Gulch
Sand (%)	55	PL	19	Sample ID:	YA-RW1
Fines (%)	40	PI	29	Sample Depth (ft.):	4
Sample Description:	SC / A - 7 - 6 (6)				

Yeh & Associates, Inc.
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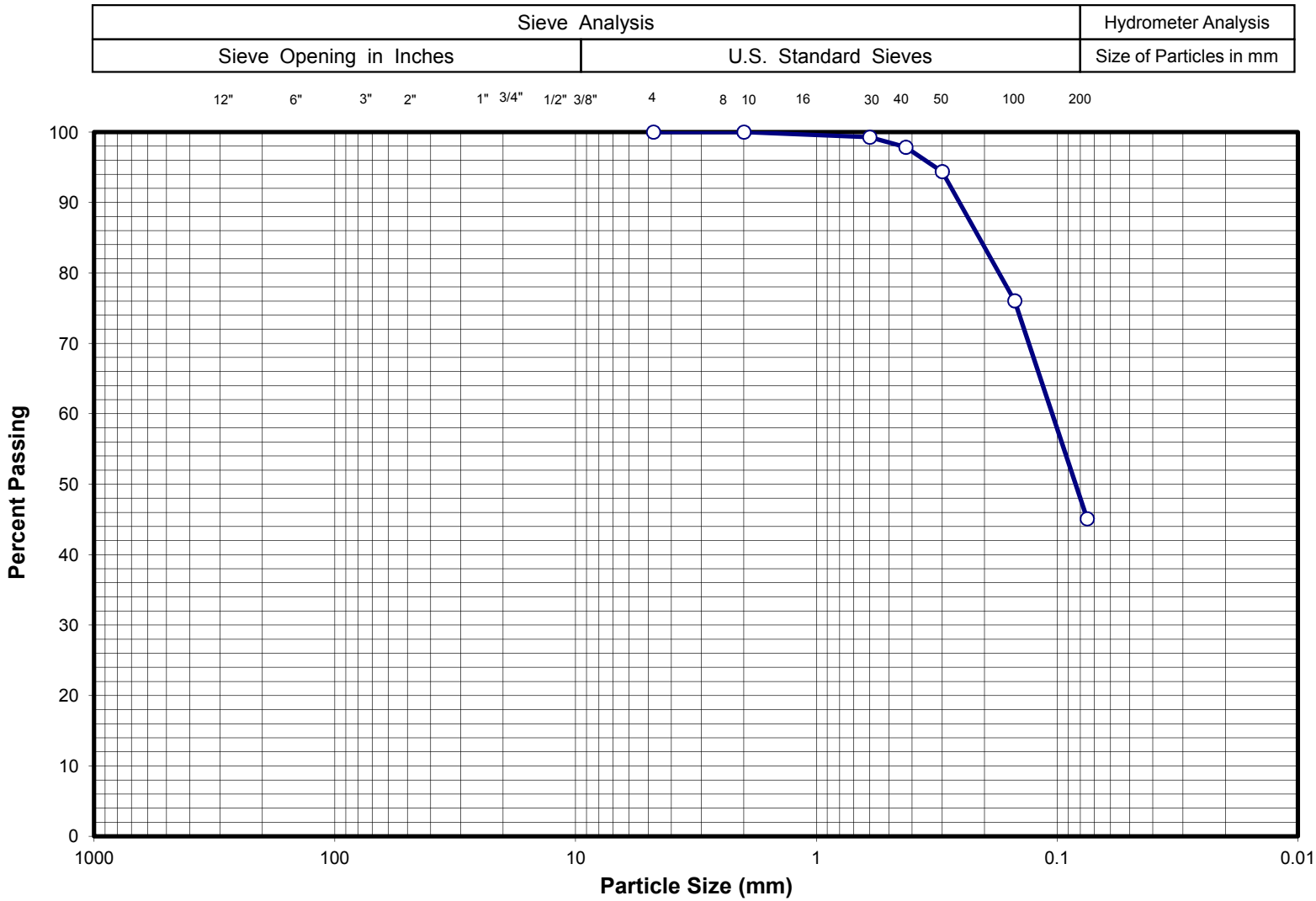
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	MLK	Figure No.:	-
Date:	12/07/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	100
#10	100
#40	98
#200	45

Gravel (%)	0	LL	NV	Project Name:	8th Ave. Retaining Wall at Weir Gulch
Sand (%)	55	PL	NP	Sample ID:	YA-RW1
Fines (%)	45	PI	NP	Sample Depth (ft.):	29
Sample Description:	SM / A - 4 (0)				

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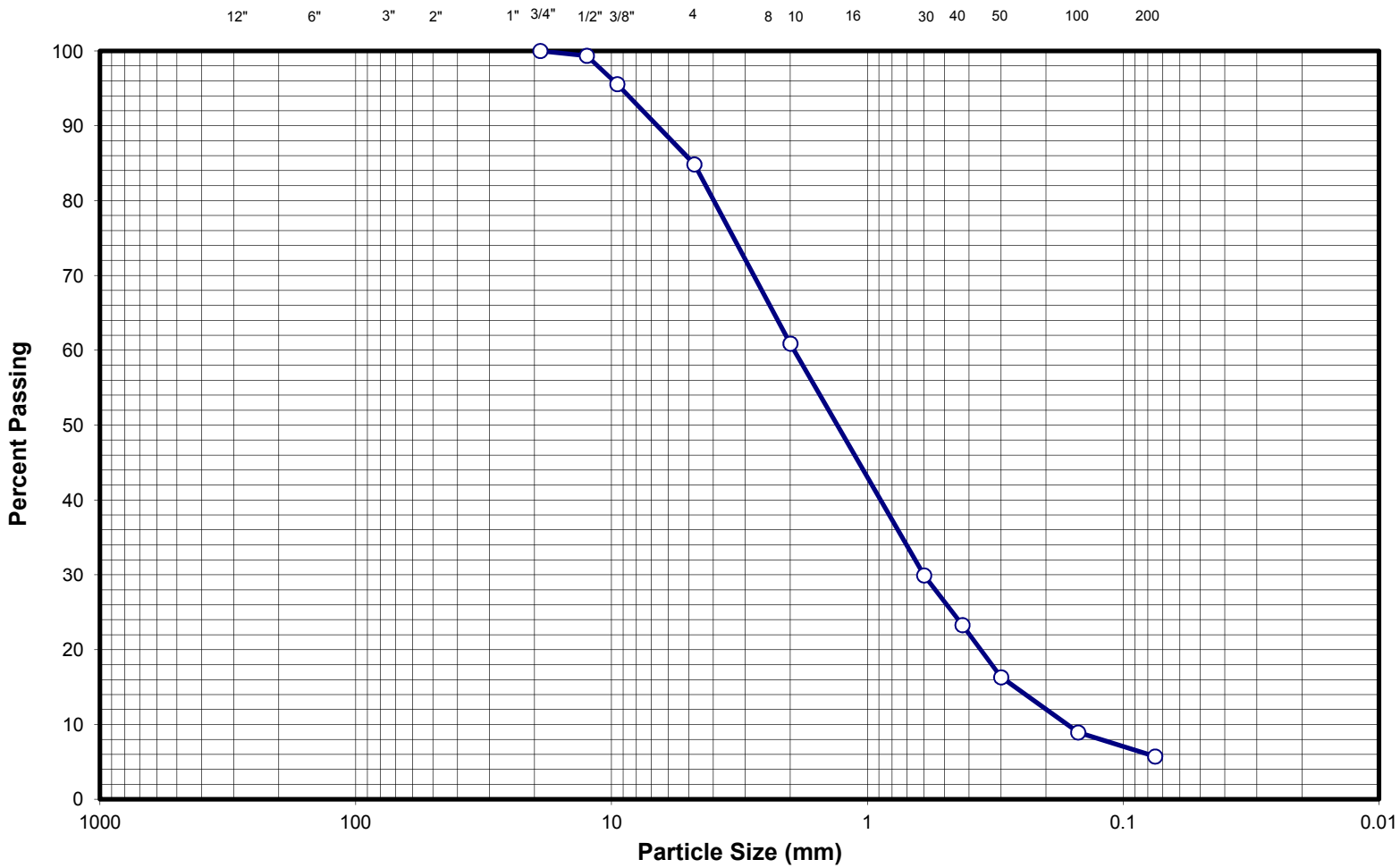
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	MLK	Figure No.:	-
Date:	12/07/11		

Revised 04/27/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	99
⅜"	96
#4	85
#10	61
#40	23
#200	6

Gravel (%)	15	LL	NV	Project Name:	8th Ave. Retaining Wall at Weir Gulch
Sand (%)	79	PL	NP	Sample ID:	YA-RW1
Fines (%)	6	PI	NP	Sample Depth (ft.):	41
Sample Description:	SP-SM / A - 1 - b (0)				

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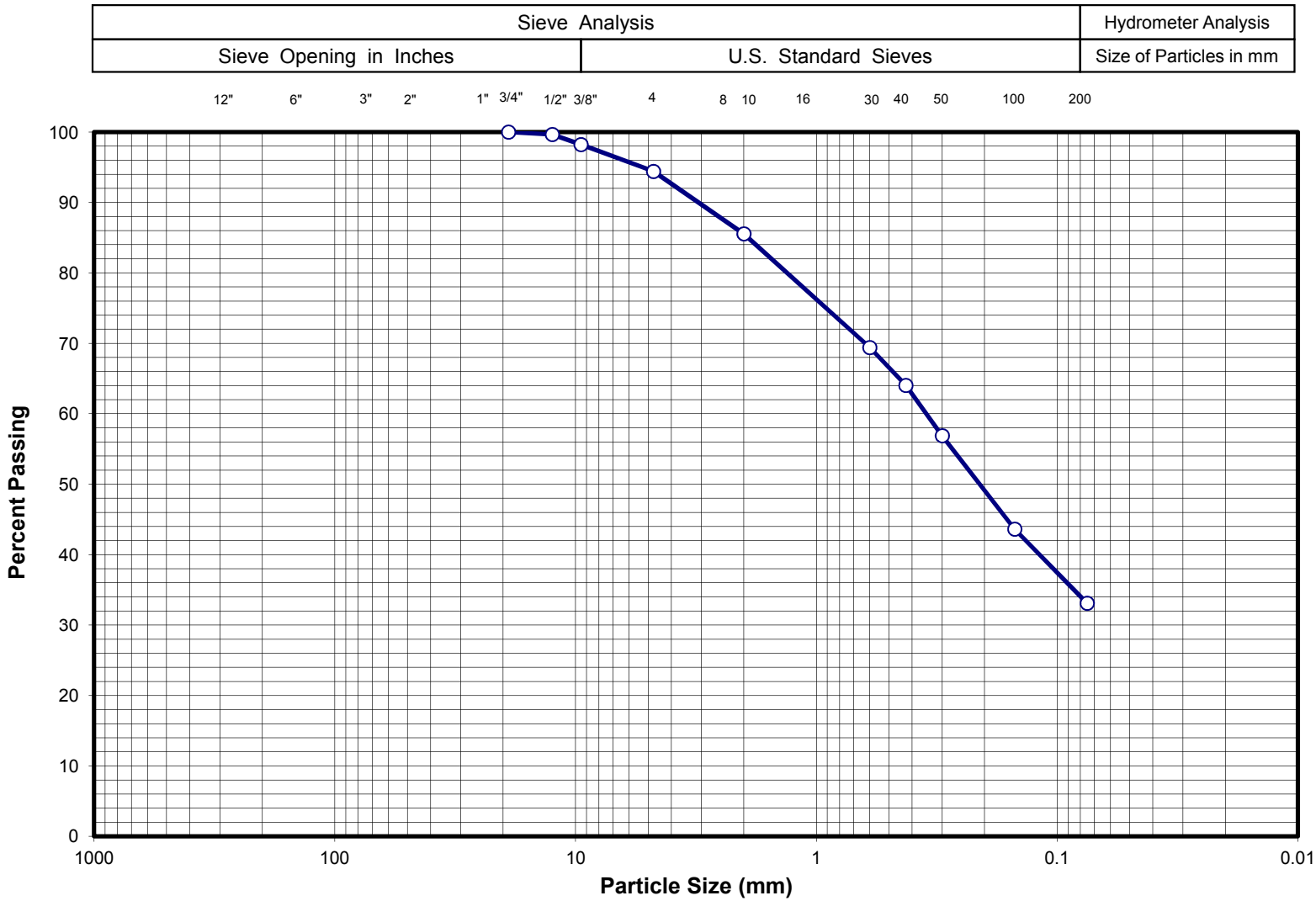
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	MLK	Figure No.:	-
Date:	12/07/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	100
⅜"	98
#4	94
#10	86
#40	64
#200	33

Gravel (%)	6	LL	35	Project Name:	8th Ave. Retaining Wall at Weir Gulch
Sand (%)	61	PL	17	Sample ID:	YA-RW2
Fines (%)	33	PI	18	Sample Depth (ft.):	0-5
Sample Description:	SC / A - 2 - 6 (0)				

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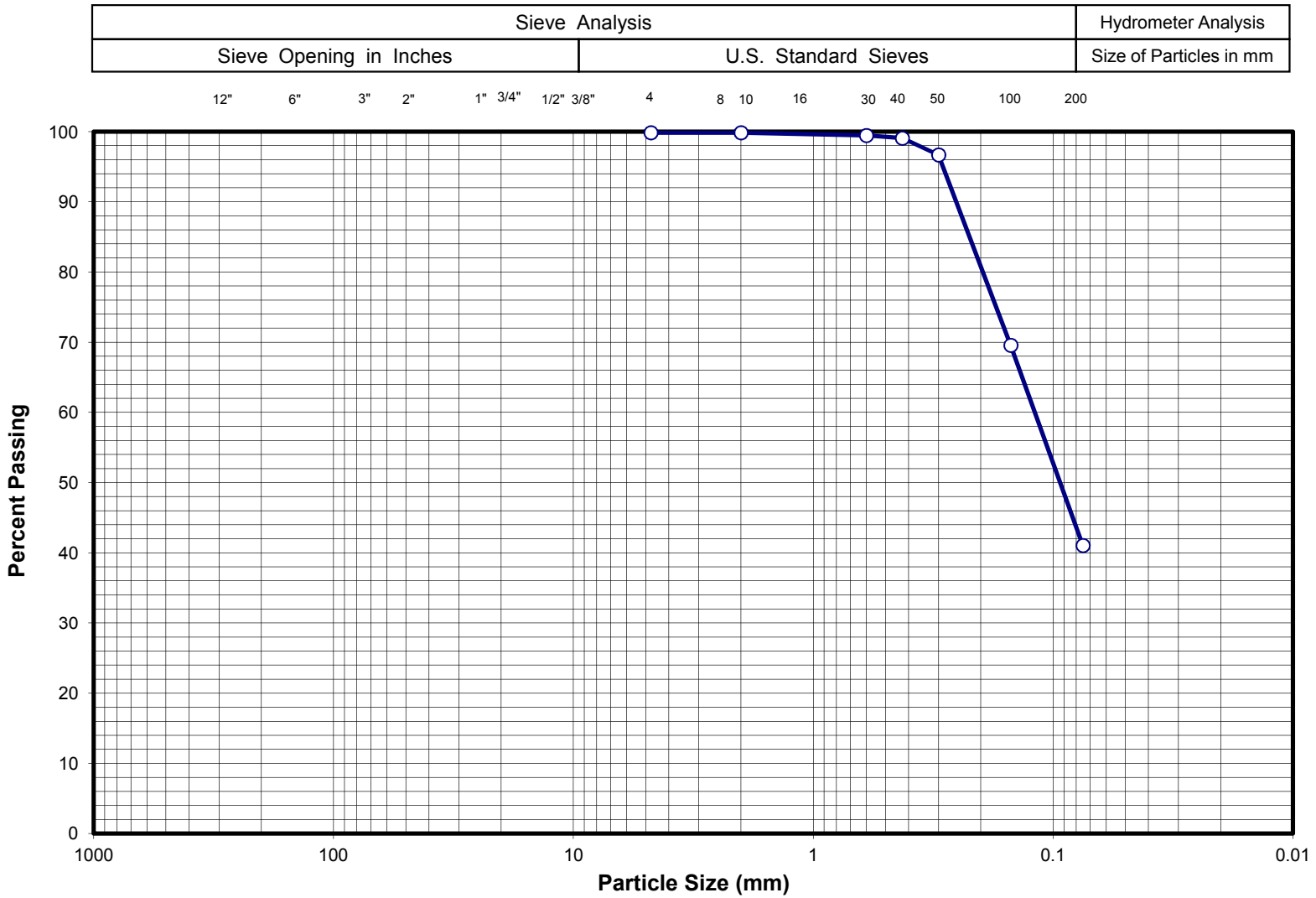
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	MLK	Figure No.:	-
Date:	12/07/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	100
#10	100
#40	99
#200	41

Gravel (%)	0	LL	NV	Project Name:	8th Ave. Retaining Wall at Weir Gulch
Sand (%)	59	PL	NP	Sample ID:	YA-RW2
Fines (%)	41	PI	NP	Sample Depth (ft.):	20
Sample Description:	SM / A - 4 (0)				

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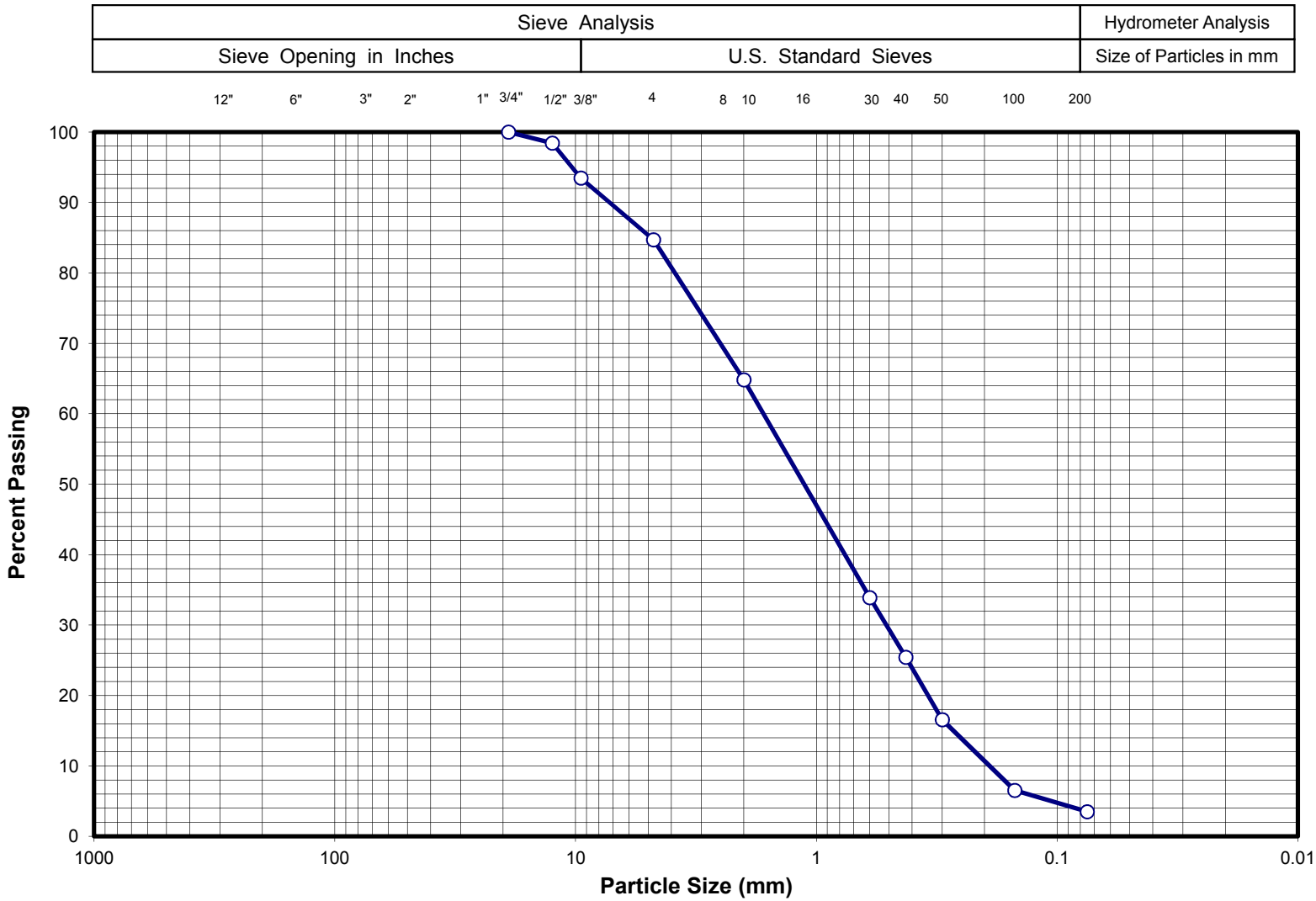
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	MLK	Figure No.:	-
Date:	12/07/11		

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	98
⅜"	93
#4	85
#10	65
#40	25
#200	4

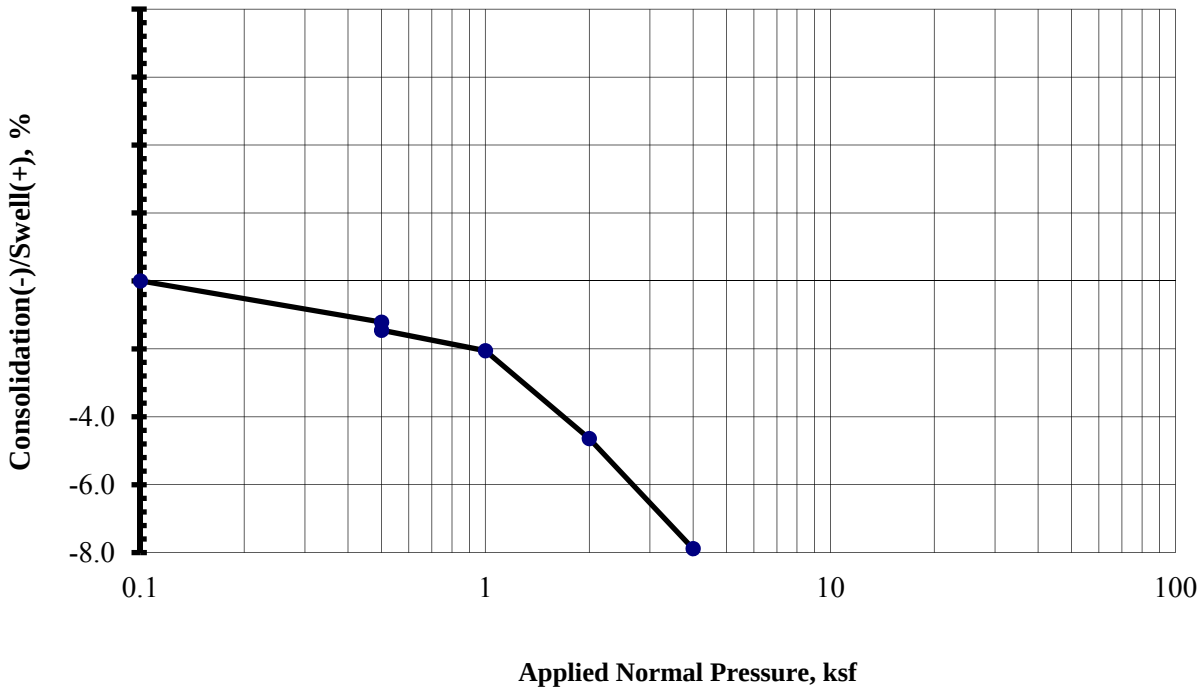
Gravel (%)	15	LL	NV	Project Name:	8th Ave. Retaining Wall at Weir Gulch
Sand (%)	81	PL	NP	Sample ID:	YA-RW2
Fines (%)	4	PI	NP	Sample Depth (ft.):	40
Sample Description:	SP / A - 1 - b (0)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	211 - 117
Checked By:	MLK	Figure No.:	-
Date:	12/07/11		

Revised 04/27/2004



Boring Number	Depth, ft	Natural Dry Density, pcf	Moisture Content, %	Consolidation(-) /Swell(+), %	Soil Description	SWELL / CONSOLIDATION GRAPH
YA-RW1	9	91.1	30.1%	-0.2	Sandy Clay	Drawn By: M.A
Job No: 211-117	Project Name:		8th Ave. Wall at Weir Gulch			Checked By: MLK

YEH & ASSOCIATES, INC

Appendix D, Global Stability Analysis

211-117 8th Ave at Gulch Existing Sta. 1+95

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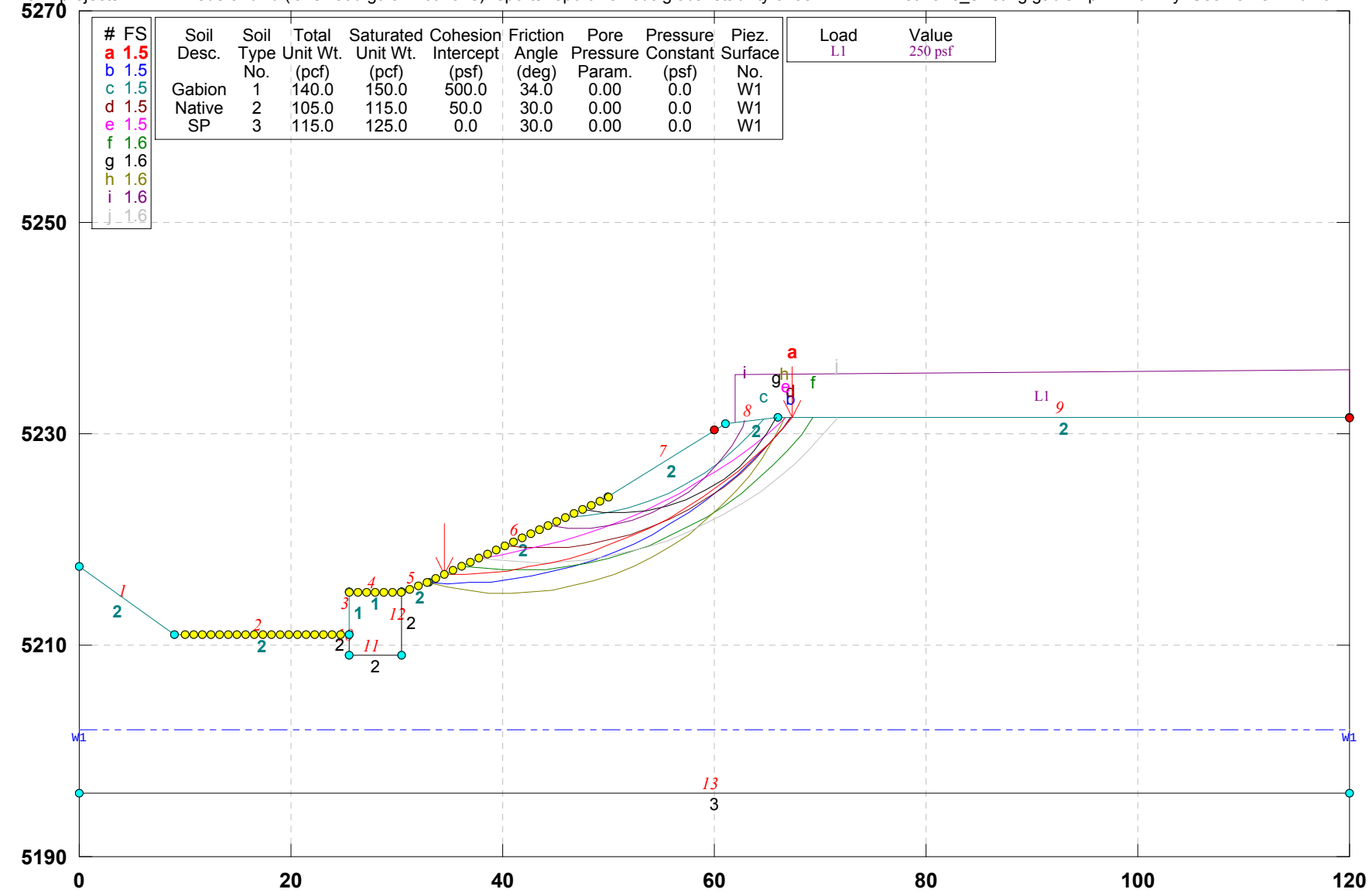

GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

211-117 8th Ave at Gulch Existing Sta. 1+95

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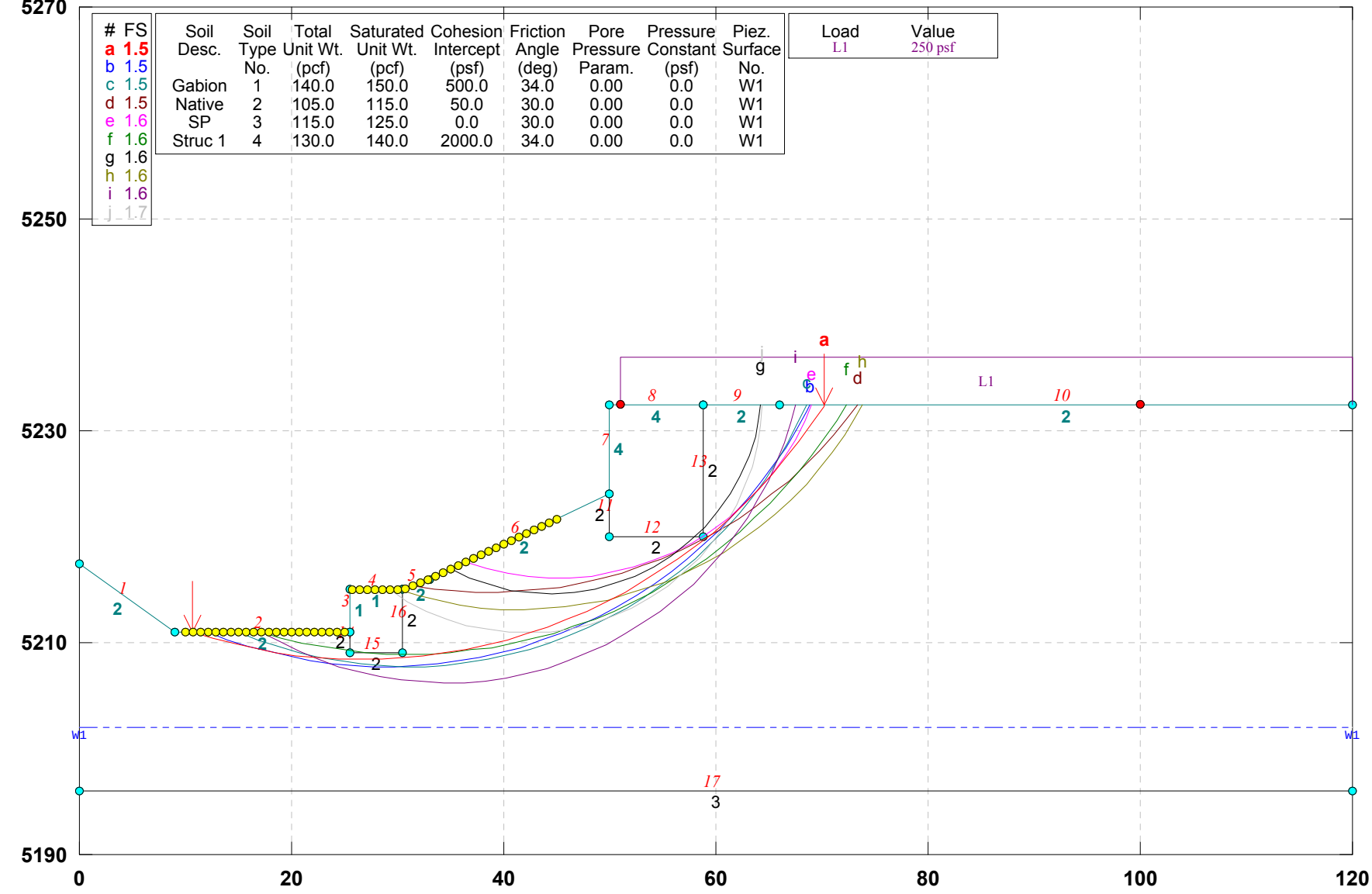

GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

Appendix F

GEOTECHNICAL DATA REPORT

FEDERAL BOULEVARD AND 8TH AVENUE PIPE JACKING

CITY AND COUNTY OF DENVER, COLORADO

Yeh Project No.: 216-457

February 7, 2017

Prepared for:

Tsiouvaras, Simmons and Holderness, Inc.
5690 DTC Blvd., Level 3, Suite 345W
Greenwood Village, Colorado 80111
Attn: Randal Lapsley P.E.

Prepared by:
Yeh and Associates, Inc.
2000 Clay Street, Suite 200
Denver, Colorado 80211

Phone: 303-781-9590

Yeh and Associates, Inc.
Consulting Engineers & Scientists

GEOTECHNICAL DATA REPORT

FEDERAL BOULEVARD AND 8TH AVENUE PIPE JACKING

CITY AND COUNTY OF DENVER, COLORADO

Yeh Project No.: 216-457

February 7, 2017

Prepared by:

COLORADO LICENSED
T. SAMUEL HOLDER
42983
PROFESSIONAL ENGINEER

2/7/2017

T. Samuel Holder, P.E.
Senior Project Manager

Reviewed by:

Samantha C. Sherwood, P.E.
Senior Geotechnical Engineer

Independent Reviewer:

Howard Hume Ph.D., P.G
Sr. Project Manager

Yeh and Associates, Inc.
Consulting Engineers & Scientists

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List of Appendices

1. PURPOSE AND SCOPE OF STUDY

This report presents the results of our Geotechnical Investigation for the proposed Pipe Jacking Project at Federal Boulevard and 8th Avenue, City and County of Denver, Colorado. This study was performed in general accordance with our proposal. Our work consisted of field exploration, laboratory testing, and preparation of this report.

This report includes our boring logs and laboratory data for the geotechnical aspects of project design and construction. The information provided in this report is based on the conditions found at the location of our exploratory borings at the time our investigation was performed. Our findings should not be extrapolated to other areas or used for other projects without our prior review. Furthermore, they should not be used if the site has been altered without Yeh and Associates' prior review to determine if these recommendations remain valid.

The purpose of this investigation was to evaluate the geotechnical characteristics of the subsurface soils for the proposed new 54-inch storm sewer line to be pipe jacked under the roadway at Federal Blvd. and 8th Avenue. Our investigation included the following:

- Site reconnaissance by one of our engineers or geologists.
- A subsurface exploration program under the direction of one of our engineers/geologists who will supervise, log, and sample soil borings at the sites.
- Laboratory tests performed on selected samples obtained during exploration to evaluate pertinent engineering properties.
- Preparation of this report.

2. PROPOSED CONSTRUCTION

We understand the work includes a new 54-inch reinforced concrete pipe storm sewer line that crosses under Federal Boulevard at 8th Avenue. The storm sewer then continues eastward and outlets into Weir Gulch. For the crossing at Federal Boulevard, the proposed 54 inch pipe will be jacked beneath the road. The total length of the pipe to be jacked is roughly 80 feet. The storm line invert is anticipated to be about 15 feet below existing grade

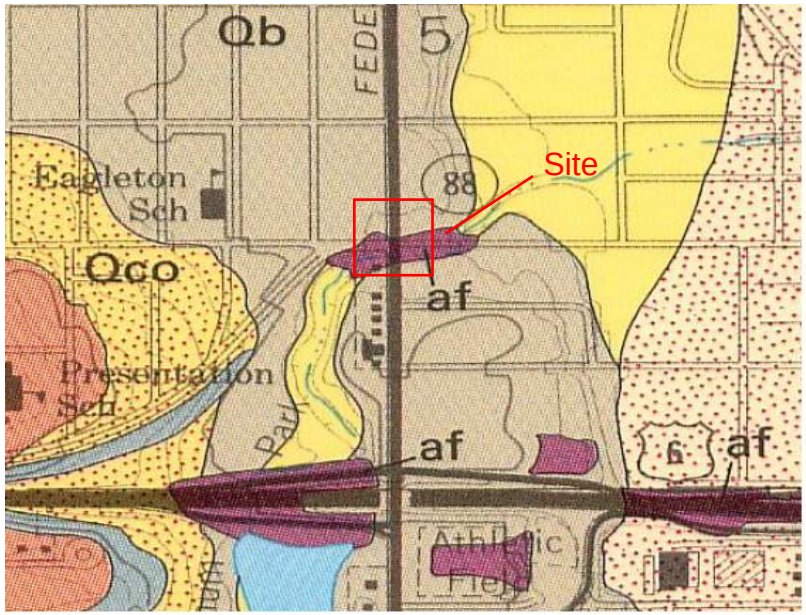
3. GEOLOGICAL SETTING AND SITE CONDITIONS

The site geology was investigated by reviewing published geologic maps and reports, and by the analysis of our test borings.

The project area is located in a geologically diverse section of the Front Range. A United States Geologic Survey (USGS) geologic map showing the project area is included as Figure 1.

Soil materials at the site consist of a varying thickness of fill, topsoil, and alluvial deposits. The area of the site is mapped by Lindvall (1978) as artificial fill (af) over Post-Piney and Piney Creek alluvium (Figure 1). The area is also mapped by Tremble and Machete (USGS, 1979) as having Broadway Colluvium (Qb) in the vicinity.

Bedrock in this area has been mapped as the Denver Formation of Paleocene and Upper Cretaceous age (TKd). The Denver Formation is described as claystone, siltstone, sandstone and conglomerate. This description is in general agreement with the soils encountered in our subsurface investigation. Bedrock was not encountered at the maximum depth of our exploration.



DESCRIPTION OF MAP UNITS

af — ARTIFICIAL FILL—Clay, silt, sand, gravel, and a variety of debris consisting of concrete, brick, wood, metal, plastic, glass, vegetation, and other trash. Includes engineered and compacted fill for highways, buildings, and bridge abutments; engineered and semi-engineered fill for dams, canal and railway embankments, stream-channelization dikes, and some sanitary landfills; and uncompacted materials in local rubbish dumps. Generally 5–15 feet (1.5–4.5 m) thick, but some dams and embankments are as much as 40 feet (12 m) thick

Qpp — POST-PINEY CREEK ALLUVIUM (HOLOCENE)—Light- to dark-grayish-brown clay, silt, sand, and small amounts of gravel. Dark-brown and dark-bluish-black humic bog clays, interbedded in places with sand and silt. Mapped chiefly in the South Platte River and Bear Creek valleys, but thin deposits are present in most minor tributary stream valleys. Deposits forming the flood plains of Bear Creek and South Platte River have a high proportion of silt. Thickness about 5–10 feet (1.5–3 m)

Qp — PINEY CREEK ALLUVIUM (HOLOCENE)—Brown, light-brown, light-gray to dark-gray interbedded sand, silt, and clay. Humic material is common in upper 1–2 feet (0.3–0.6 m), interbedded gravel in lower part. Generally well stratified; upper part of alluvium is generally finer grained than the lower part. Occupies the bottoms of almost every valley except Bear Creek and South Platte River. Commonly 5–10 feet (1.5–3 m) thick

Qco — COLLUVIUM (HOLOCENE TO PLEISTOCENE)—Gray, dark-gray, brown to light-brown sandy silt and clay. In places may contain pebbles and cobbles. Developed on steep to gentle slopes; generally transitional downslope into Piney Creek Alluvium. Commonly less than 5 feet (1.5 m) thick

Qes — EOLIAN SAND (HOLOCENE AND PLEISTOCENE)—Light-brown, fine sand and sandy silt. In some localities may contain large amounts of clay and silty clay. Crossbedded in some places, but generally structureless. Deposits are confined to the east side of South Platte River valley in the southeastern part of the quadrangle. Generally less than 10 feet (3 m) thick, but locally may be as much as 30 feet (9 m) thick

Qb — BROADWAY ALLUVIUM (PLEISTOCENE)—Pink to light-brown, generally well-stratified sand and gravel, in well-formed terraces along South Platte River and Lakewood and McIntyre Gulches. Alluvium on west side of South Platte River and along the tributaries generally is fine sand and silt. Upper surfaces of terrace deposits are about 25–30 feet (7.6–9 m) above modern major streams. As much as 30 feet (9 m) thick

Figure 1. Site Geology Map and Legend

4. SUBSURFACE INVESTIGATION

4.1 Field Exploration

The subsurface conditions for the Federal Blvd storm drain pipe jacking project were explored by drilling 3 borings. Borings YA-FED-1 and YA-FED-2 were drilled on December 20, 2016 with a truck-mounted CME 55 drill rig. Boring YA-FED-3 was drilled on December 28, 2016 with a CME 550 drill rig. The drill rigs are owned and operated by Dakota Drilling. The borings were advanced using solid-stem auger drilling methods.

Penetration resistance measurements were taken by driving a Modified California Sampler into the subsurface materials with a 140-pound manual hammer falling 30 inches. The Modified California is a 2.5-inch O.D., 2-inch I.D. (1.95-inch with liners) split barrel sampler with internal liners, per ASTM D3550. The Modified California Sampler drive length is 12 inches and "Penetration Resistance" refers to the sum of all blows. The penetration resistance value is a useful index to evaluate the consistency and relative density or hardness of the materials encountered.

The borings were located in the field and logged by Yeh and Associates representatives. Boring elevations and locations are approximate.

4.2 Subsurface Conditions

YA-FED-1 is the west boring located in the parking lot at the northeast corner of the intersection. Boring YA-FED-1 encountered on the surface about 3 ½ inches of asphalt. Below the asphalt, silty sand fill was encountered to a depth of 3 feet. Underlying the sand fill, sandy clay/clayey sand with varying amounts of gravel was encountered to 31 feet where the boring was terminated. Bedrock was not encountered to the maximum depth of exploration. Field penetration data indicates that the sand soils were medium dense in relative density and the clay soils vary from stiff to very stiff in consistency.

YA-FED-2 is the boring also located in the parking lot at the northeast corner of the intersection, east of Boring YA-FED-2. The boring encountered 3½ inches of asphalt from the surface. Below the asphalt, sandy clay was encountered to 18½ feet, followed by high plastic clay to 22 feet, then sandy clay to 28.5 feet. Clayey sand was then encountered to 31 feet where the boring was terminated. Bedrock was not encountered to the maximum depth of exploration. Field

penetration data indicates that the clay soils were stiff to very stiff in consistency and the sand soils were medium dense in relative density.

Boring YA-FED-3 was located in the northwest corner of the intersection of Federal Boulevard. and 8th Avenue. The boring encountered 6 inches asphalt from the surface. Below the asphalt high plastic sandy clay fill was encountered to 7 feet. A layer of clayey sand fill with varying amount of gravel was encountered from 7 to 12 feet. Below the sand, sandy clay fill with construction debris (nails) was encountered to 16 feet. Silty sand fill with varying amount of cobbles and construction debris (wood) was encountered to 23 feet (Figure 2) followed by clayey sand to 31 feet where the boring was terminated. A petroleum odor was noted for the full depth of the boring. Pinyon, who was on-site during drilling to monitor conditions for worker safety, recorded positive PID reading at 25 feet.

Figure 2 Wood encountered in YA-FED-3 at 20 Feet

Field penetration data indicates that the sand soils vary from medium dense to very dense in relative density and the clay soils were stiff to very stiff in consistency. The cobbles could account for the higher blow count. Bedrock was not encountered in the boring.

The approximate boring locations are presented on the Engineering Geology Sheets in Appendix A. The investigation logs are presented in Appendix B. The borings were located in the field from existing site features. The accuracy of boring locations should only be assumed to the level implied by the methods used.

Previous Borings

In December 2011, Yeh conducted an investigation for a pavement design on Federal Boulevard and a retaining wall along 8th Avenue at Weir Gulch. Boring P-16 was drilled in the northwest corner of the intersection of Federal Boulevard and 8th Avenue near YA-FED-3. Borings YA-RW1 and YA-RW2 were drilled east of YA-FED-2. Approximate location of these borings is included on the plan view of Engineering Geology Sheet 1 in Appendix A and logs are provided on the profile view of Engineering Geology Sheet 2. The boring logs are provided in Appendix B.

4.3 Laboratory Testing

Selected soil samples were tested in the laboratory to determine the classification and engineering properties of the materials encountered in the borings. The testing was conducted in general accordance with recognized test procedures, primarily those of the American Society for Testing and Materials (ASTM) and American Association of State Highway and Transportation Officials (AASHTO). Laboratory tests were performed on selected soil and bedrock samples to estimate their relative engineering properties. The following tests were performed in general accordance with locally recognized standards:

Description and Identification of Soils (Visual-Manual Procedure)
Moisture Determination
Atterberg limits
Unit Weight
One Dimensional Swell-Settlement
Water Soluble Sulfates
Resistivity
Chlorides
pH

A total of nine (9) classification tests (sieve analyses and Atterberg limits) were performed on samples obtained from the borings. In the AASHTO soil classification system, one (1) of the samples classified as A-1-b (0), one (1) classified as A-2-4 (0), one (1) as a A-2-6 (0) one (1) as a A-6 (10), and five (5) soil samples classified as A-7-6 with group indices varying from 10 to 53.

In the ASTM system, three (3) samples classified as SC, one (1) as SM, three (3) classified as CH and two (2) classified as CL.

Details of laboratory test results are presented in Appendix C and they are integrated with the investigation logs in Appendix B.

4.4 Groundwater

Groundwater was encountered in boring YA-FED-3 at 27 feet below existing grade. Boring YA-FED-1 and YA-FED-2 did not encounter groundwater. These observations represent groundwater conditions at the time of field exploration, and may not be indicative of other times, or at other locations. Groundwater levels should be expected to fluctuate with varying seasonal and weather conditions.

5. EXCAVATIONS

Excavations into the on-site soils will encounter a variety of conditions. All excavations must comply with the applicable local, State, and Federal safety regulations, and particularly with the excavation standards of the Occupational Safety and Health Administration (OSHA). Construction site safety, including excavation safety, is the sole responsibility of the Contractor as part of its overall responsibility for the means, methods, and sequencing of construction operations. Yeh and Associates recommendations for excavation support is provided for the Client's sole use in planning the project, in no way do they relieve the Contractor of its responsibility to construct, support, and maintain safe slopes. Under no circumstances should the following recommendations be interpreted to mean that Yeh and Associates is assuming responsibility for either construction site safety or the Contractor's activities.

We believe the overburden clays encountered on this site will classify as Type B materials and the sands will classify as Type C material. OSHA requires that unsupported cuts be no steeper than 1:1 for Type B material and 1½:1 for Type C soils for unbraced excavations up to 20 feet in height. In general, we believe that these slope ratios will be temporarily stable under unsaturated conditions. Flattened slopes may be required if excavations encounter groundwater or the slopes will be exposed for an extended period of time. Please note that an OSHA-qualified "competent person" must make the actual determination of soil type and allowable sloping in the field.

The soils encountered by the proposed excavations may vary significantly across the site. The preliminary classifications presented above are based solely on the materials encountered in widely spaced exploratory test borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation.

As a safety measure, it is recommended that all vehicles and soil piles be kept to a lateral distance equal to at least the depth of the excavation from the crest of the slope. The exposed slope face should be protected against the elements and monitored by the contractor on at least a daily basis.

6. CORROSION AND CONCRETE DEGRADATION

The concentration of water-soluble sulfates measured in the laboratory on a representative sample of the clay soils varied from <0.001 to 0.008 percent. This concentration of water-soluble sulfates represents a Class 0 degree of sulfate attack on concrete exposed to these geologic materials. The degree of attack is based on a range of Class 0 (negligible) to Class 3 (very severe) as described in the American Concrete Institute (ACI) Standard 201.2R, "Guide to Durable Concrete". Based on the sulfate test result, a Class 0 severity of concrete exposure is appropriate for all concrete on site per CDOT specification 601.14.

The pH, water soluble chlorides, and electrical resistivity were determined for selected samples. Test results measured pH values of 7.8 and 7.9 (slightly basic). Water soluble chlorides samples measured 0.0016 and 0.0022 percent. The soil resistivity measurements were 1130 and 2079 ohm-centimeters. A qualified corrosion engineer should review this data to determine the appropriate level of corrosion protection.

7. SEISMIC CONSIDERATIONS

Based upon the nature of the subsurface materials, a Site Class D should be used for the design of the structure for the proposed project (ASCE 7-10 Standard), Site coordinates 39.728^0 N, 105.0254^0 W). The project site is located in seismic area with a mapped maximum short period (S_S) and 1-second period (S_1) ground motion, respectively, of 0.185 g and 0.0.059 g as indicated on Figures 22-1 and 22-2. The site coefficients, Fa and Fv, for the same periods are 1.6 and 2.4, respectively. Using a risk category I or II, the seismic design category is B.

8. REFERENCES

1. US Seismic Design Maps, ASCE 7-10 Standard, USGS Earthquake Hazard Program.
2. Geologic map of the Fort Logan quadrangle, Jefferson, Denver, and Arapahoe Counties, Colorado, R.M. Lindvall, 1978.
3. Geological Map of the Greater Denver Area Front Range Urban Corridor Colorado by Donald Tremble and Michael Machete, 1979.
4. Colorado Department of Transportation, Standard Specification for Road and Bridge Construction, 2011.
5. AASHTO LRFD Bridge Design Specifications, Seventh Edition 2014
6. ASCE 7-10, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, 2010
7. City and County of Denver, Building Regulations - 2016 Amendments
8. Geotechnical Engineering Report; 8th Avenue Retaining Wall at Weir Gulch, East of Federal Boulevard, Denver, Colorado. CCD Project Number: CC 0881-025. September 6, 2012.

9. LIMITATIONS

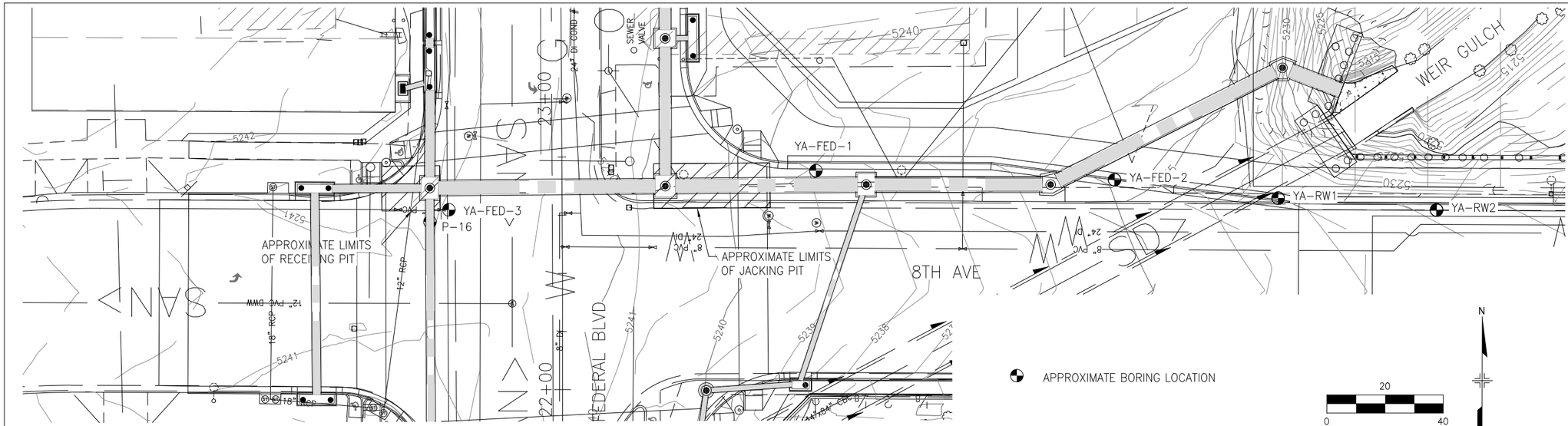
The recommendations in this report are based on our field observations, laboratory testing, and our present understanding of the proposed construction. It is possible that subsurface conditions can vary beyond the point explored. If the conditions found during construction differ from those described in this report, please notify us immediately so that we can review our report in light of those conditions and provide supplemental recommendations as necessary. We should also review this report if the scope of the proposed construction, including the proposed loads or structure locations, changes from that described in this report.

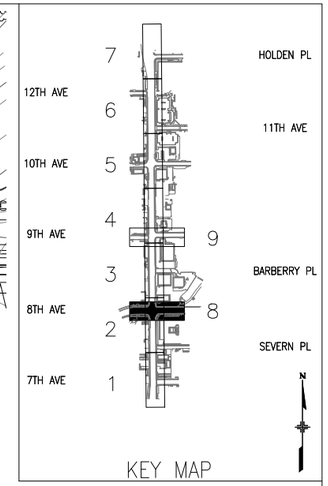
Yeh and Associates has prepared this report for the exclusive use of Tsiouvaras, Simmons Holderness, Inc. for the proposed pipe jacking in the intersection of Federal Boulevard and 8th Avenue in the City and County of Denver, Colorado. This report was prepared in substantial accordance with the generally accepted standards of practice for geotechnical engineering as exist in the site area at the time of our investigation. No warranty is expressed or implied. The recommendations in this report are based on the assumption that Yeh and Associates will conduct an adequate program of construction testing and observation to evaluate compliance with our recommendations.

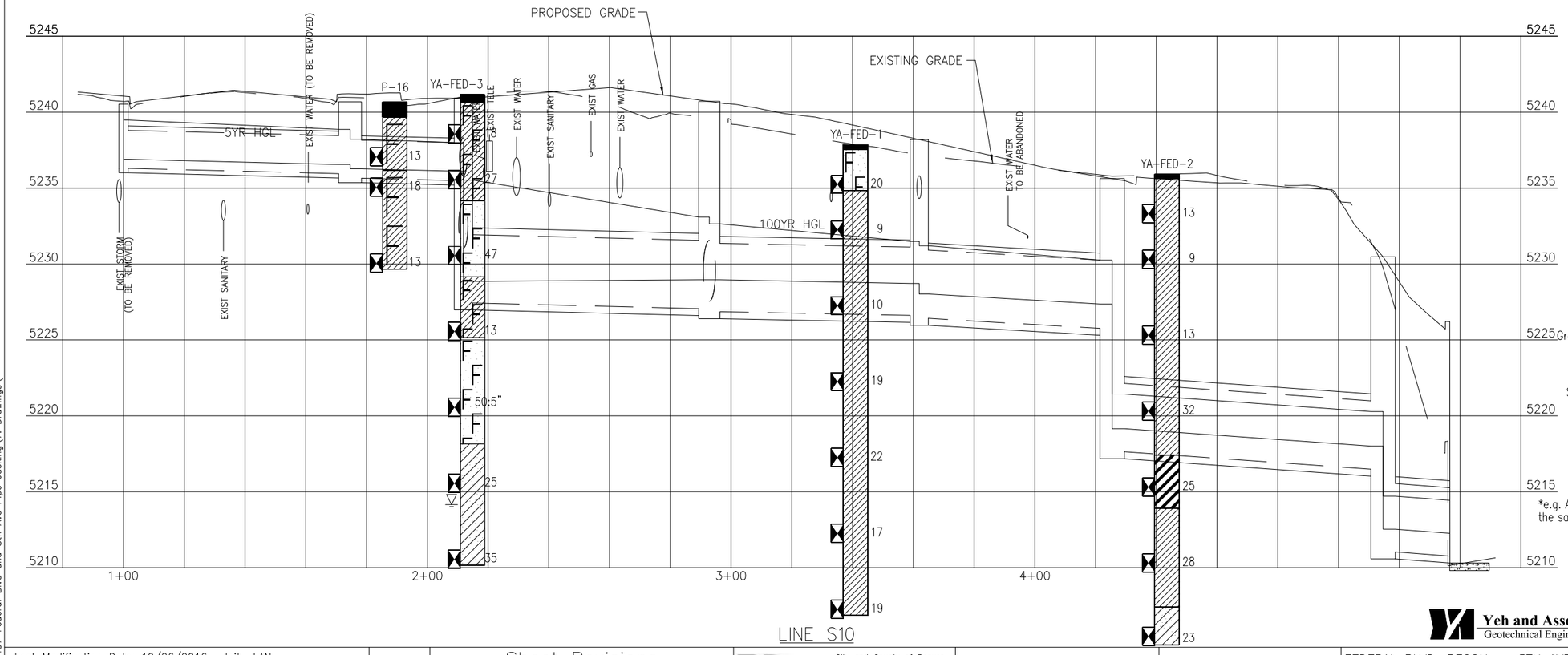
APPENDICES

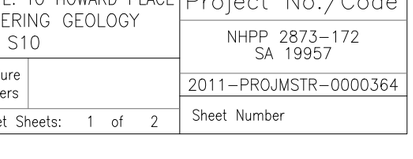
Appendix A

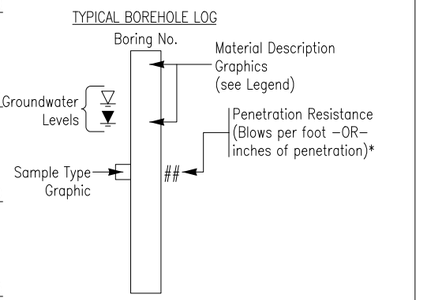
ENGINEERING GEOLOGY SHEETS











*e.g. A value of 50/3 or 50:3 indicates that 50 blows were applied to the sampler, with a penetration of 3 inches.

Yeh and Associates, Inc.
Geotechnical Engineering Consultants

TSIOUVARAS SIMMONS HOLDERNESS
CONSULTING ENGINEERS

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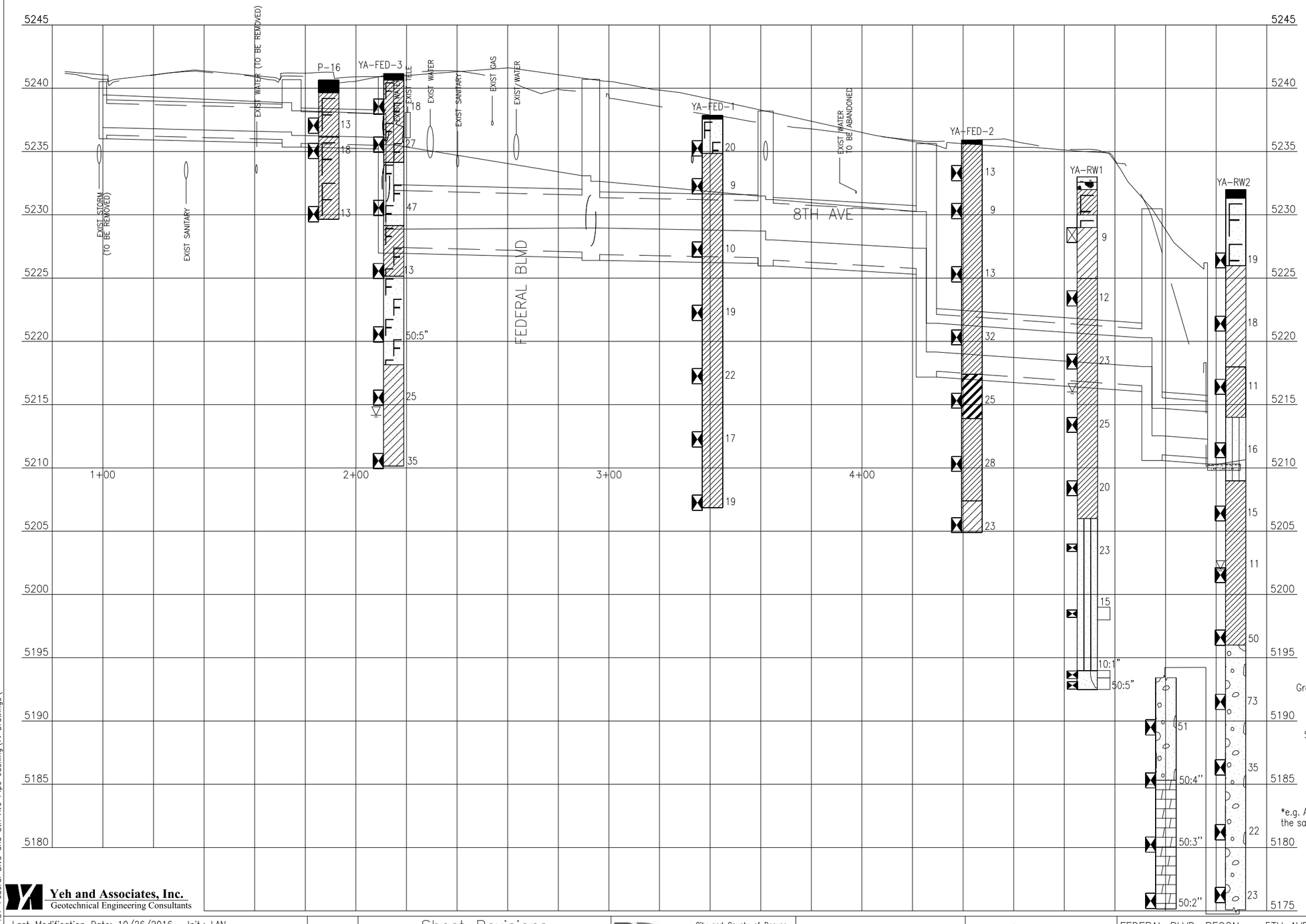
Denver, CO 80222
Phone: 303-757-9511 FAX: 303-757-9907
Region 1 JV

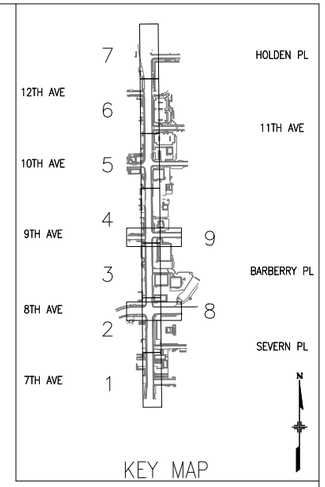
As Constructed
No Revisions:
Revised:
Void:

FEDERAL BLVD. RECON. – 5TH AVE. TO HOWARD PLACE
STORM SEWER – ENGINEERING GEOLOGY
PH 1 – LINE S10

Designer:	HH	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOTECH	Subset Sheets:	1 of 2

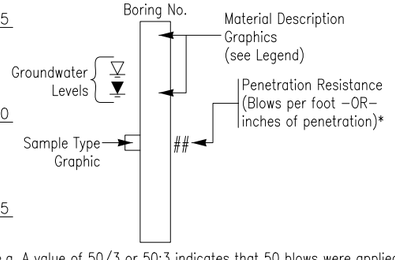
Project No./Code
NHPP 2873-172
SA 19957
2011-PROJMSTR-0000364
Sheet Number





USCS Low Plasticity Sandy Clay
USCS High Plasticity Clay
USCS Well-graded Gravel
Concrete
Asphalt
CLAYSTONE
Fill with Clay as major soil
Fill with Sand as major soil
USCS Silty Sand
USCS Poorly-graded Gravelly Sand
USCS Low Plasticity Clay
USCS Clayey Sand

TYPICAL BOREHOLE LOG



*e.g. A value of 50/3 or 50:3 indicates that 50 blows were applied to the sampler, with a penetration of 3 inches.

Yeh and Associates, Inc.
Geotechnical Engineering Consultants

TSIOUVARAS SIMMONS HOLDERNESS
CONSULTING ENGINEERS

Last Modification Date: 10/26/2016 Init.: LAN
Drawing File Name: 1102188-07-Geotech_Phasing_PH1-02.dwg
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Sheet Revisions

Date:	Comments	Init.

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As Constructed
No Revisions:
Revised:
Void:

FEDERAL BLVD. RECON. – 5TH AVE. TO HOWARD PLACE
STORM SEWER – ENGINEERING GEOLOGY
PH 1 – LINE S10

Designer:	HH	Structure Numbers	
Detailer:	MJW		
Sheet Subset:	GEOTECH	Subset Sheets:	2 of 2

Project No./Code
NHPP 2873-172
SA 19957
2011-PROJMSTR-0000364
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Appendix B

BORING LOGS

Yeh and Associates, Inc.
Consulting Engineers & Scientists

Project: Federal Pipe Jacking

Project Number: 216-457

Legend for Symbols Used on Borehole Logs

Sample Types


Auger Cuttings


Modified California Sampler (2.5 inch OD, 2.0 inch ID)

Lithology Symbols (see Boring Logs for complete descriptions)


Asphalt


USCS High Plasticity Clay


USCS Low Plasticity Clay


Fill with Clay as major soil


Fill with Sand as major soil


USCS Clayey Sand


USCS Silty Sand

Lab Test Standards

Moisture Content	ASTM D2216
Dry Density	ASTM D7263
Sand/Fines Content	ASTM D421, ASTM C136, ASTM D1140
Atterberg Limits	ASTM D4318
AASHTO Class.	AASHTO M145, ASTM D3282
USCS Class.	ASTM D2487

(Fines = % Passing #200 Sieve
Sand = % Passing #4 Sieve, but not passing #200 Sieve)

Other Lab Test Abbreviations

pH	Soil pH (AASHTO T289-91)
S	Water-Soluble Sulfate Content (AASHTO T290-91, ASTM D4327)
Chl	Water-Soluble Chloride Content (AASHTO T291-91, ASTM D4327)
S/C	Swell/Consolidation (ASTM D4546)
UCCS	Unconfined Compressive Strength (ASTM D2166)
R-Value	Resistance R-Value (ASTM D2844)
DS (C)	Direct Shear cohesion (ASTM D3080)
DS (phi)	Direct Shear friction angle (ASTM D3080)
Re	Electrical Resistivity (AASHTO T288-91)
PtL	Point Load Strength Index (ASTM D5731)

Notes

1. "Penetration Resistance" on the Boring Logs refers to the N value for SPT samples only, as per ASTM D1586. For samples obtained with a Modified California sampler, drive depth was 12 inches, and "Penetration Resistance" refers to the sum of all blows. For all sample types, where blow counts were more than 50 for the last increment, the blows and length for the last increment are reported under "Penetration Resistance."

2. The Modified California sampler used to obtain samples is a 2.5-inch OD, 2.0-inch ID (1.95-inch ID with liners), split-barrel sampler with internal liners, as per ASTM D3550. Sampler is driven with a 140-pound hammer, dropped 30 inches per blow.

Yeh and Associates, Inc.
Consulting Engineers & Scientists

Project Name: Federal Pipe Jacking

Project Number: 216-457 *Boring No.:* **YA-FED-1**

Boring Began: 12/20/2016
Boring Completed: 12/20/2016
Drilling Method(s): Solid-Stem Auger
Driller: Dakota
Drill Rig: CME 55
Hammer Type: Cathead and rope

Total Depth: 31.0 ft
Ground Elevation: 5238.0 ft
Coordinates: N: E:
Location: Federal & 8th Ave. NE parking lot W boring
Logged By: R. Desterhouse
Final By: R. Desterhouse

Weather Notes: Clear
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels: Not Observed

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples: Blows per 6 in	Soil Samples: Penetration Resistance	Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits: Liquid Limit	Atterberg Limits: Plasticity Index	AASHTO & USCS Classifi-cations	Field Notes and Other Lab Tests
5235						**0.0 - 0.3 ft. 3 1/2" ASPHALT**.									
						0.3 - 3.0 ft. silty SAND FILL, brown, moist, medium dense, gravel.									
			9-11	20											
						3.0 - 31.0 ft. sandy CLAY with clayey sand layers, brown-dark brown and dark gray, low to high plasticity, moist, stiff to very stiff.									
	5		4-5	9											
5230															
	10		4-6	10			27.4	92.5	0	25	75	54	36	A-7-6 (26) CH	
5225															
	15		7-12	19		Clayey Sand with trace gravel.	18.6	108.4	3	50	47	50	31	A-7-6 (10) SC	
5220															
	20		12-10	22			18.3	110.7	0	43	57	38	24	A-6 (10) CL	
5215															
	25		8-9	17											
5210															
	30		9-10	19		Rust staining.									
5205						Bottom of Hole at 31.0 ft.									

Yeh and Associates, Inc.
Consulting Engineers & Scientists

Project Name: Federal Pipe Jacking

Project Number: 216-457 *Boring No.:* **YA-FED-2**

Boring Began: 12/20/2016
Boring Completed: 12/20/2016
Drilling Method(s): Solid-Stem Auger
Driller: Dakota
Drill Rig: CME 55
Hammer Type: Cathead and rope

Total Depth: 31.0 ft
Ground Elevation: 5236.0 ft
Coordinates: N: E:
Location: Federal & 8th Ave. NE parking lot E boring
Logged By: R. Desterhouse
Final By: R. Desterhouse

Weather Notes: Clear
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels: Not Observed

Symbol			
Depth	-	-	-
Date	-	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples: Blows per 6 in	Soil Samples: Penetration Resistance	Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits: Liquid Limit	Atterberg Limits: Plasticity Index	AASHTO & USCS Classifications	Field Notes and Other Lab Tests
5235						**0.0 - 0.3 ft. 3 1/2" ASPHALT**.									
						0.3 - 18.5 ft. sandy CLAY, brown, moist, stiff to very stiff.									
			6-7	13											
	5		4-5	9											
5230															
	10		6-7	13			27.3	94.4	0	28	72	44	22	A-7-6 (15) CL	
5225															
	15		13-19	32		Rust staining.	27.0	98.7							pH=7.9 S=0.001% Chl=0.0022% Re=1130ohm·cm
5220															
						18.5 - 22.0 ft. CLAY, brown, high plasticity, moist, very stiff, rust staining.									
	20		12-13	25			36.2	83.5	0	1	99	74	45	A-7-6 (53) CH	
5215															
						22.0 - 28.5 ft. sandy CLAY, brown, moist, very stiff, rust staining, calcareous.									
	25		13-15	28											
5210															
						28.5 - 31.0 ft. clayey SAND, brown, moist, medium dense, rust staining.									
	30		9-14	23											
5205						Bottom of Hole at 31.0 ft.									

Yeh and Associates, Inc.
Consulting Engineers & Scientists

Project Name: Federal Pipe Jacking

Project Number: 216-457 *Boring No.:* **YA-FED-3**

Boring Began: 12/28/2016
Boring Completed: 12/28/2016
Drilling Method(s): Solid-Stem Auger
Driller: Dakota
Drill Rig: CME 55
Hammer Type: Cathead and rope

Total Depth: 31.0 ft
Ground Elevation: 5241.0 ft
Coordinates: N: E:
Location: Intersection of Federal Blvd. & 8th Ave.
Logged By: R. Desterhouse
Final By: R. Desterhouse

Weather Notes: Clear
Inclination from Horiz.: Vertical
Night Work: ☐

Groundwater Levels:			
Symbol	▽		
Depth	27.0 ft	-	-
Date	12/28/16	-	-

Elevation (feet)	Depth (feet)	Sample Type/ Advancement Method	Soil Samples: Blows per 6 in	Soil Samples: Penetration Resistance	Lithology	Material Description	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)	Atterberg Limits: Liquid Limit	Atterberg Limits: Plasticity Index	AASHTO & USCS Classifications	Field Notes and Other Lab Tests
5240						**0.0 - 0.5 ft. 6" ASPHALT**.									
			6-12	18		**0.5 - 7.0 ft. sandy CLAY FILL**, brown, high plasticity, moist, very stiff, petroleum odor.									
	5														
5235			12-15	27			22.9	102.4	0	32	68	51	31	A-7-6 (20) CH	
						7.0 - 12.0 ft. clayey SAND FILL, brown, low plasticity, damp, dense, fine gravel.									
	10														
5230			19-28	47			8.6	126.1	3	65	32	25	11	A-2-6 (0) SC	
						12.0 - 16.0 ft. sandy CLAY FILL, dark gray, moist, stiff, petroleum odor, construction debris (nails).									
	15														
			7-6	13			21.4	99.9							pH=7.8 S=0.008% Chl=0.0016% Re=2079ohm·cm
5225						**16.0 - 23.0 ft. silty SAND FILL** with cobbles, light brown, dry, very dense, musty smell (top of liner), petroleum odor in wood on bottom of liner.									
	20														
			50:5"	50:5"			14.4		3	78	19	NV	NP	A-1-b (0) SM	
5220															
						23.0 - 31.0 ft. clayey SAND, dark gray, low plasticity, moist to wet, medium dense to dense, petroleum odor.									
	25														
			12-13	25			13.3	124.6	2	79	19	27	9	A-2-4 (0) SC	**25.0 ft** - Pinyon positive PID reading
5215	▽														
	30														
			15-20	35											
5210						Bottom of Hole at 31.0 ft.									

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Legend for Symbols Used on Borehole Logs

Sample Types

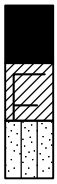

Auger Cuttings


Grab Sample


Modified California Sampler


Split Spoon

Soil Lithology


Asphalt

Fill with Clay as major soil

USCS Silty Sand


CLAYSTONE

Fill with Sand as major soil

USCS Poorly-graded Gravelly Sand


USCS Low Plasticity Sandy Clay

USCS Well-graded Gravel


Concrete

USCS Clayey Sand

Lab Test Abbreviations

MC-Moisture Content
DD-Dry Density
#200-Percent Passing #200 Sieve
LL-Liquid Limit
PL-Plastic Limit
PI-Plastic Index
S-Sulphate Content
S/C-Swell/Consolidation
UCCS-Unconfined Compressive Strength
Re-Resistivity
PtL-Point Load Test
AASHTO-AASHTO Classification
USCS-USCS Classification
Cl-Chloride

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW1**
Sheet 1 of 2

Boring Began: 12/7/2011
Drilling Method: Hollow-Stem Auger (8" O.D.)
Drill: Boart Longyear 66
Driller: Dakota Drilling
Logged By: K. Asay
Final By: I. Chen
Inclination: Vertical

Completed: 12/7/2011
Drill Bit:
Casing:
Weather:

Total Depth: 40.5 ft
Ground Elevation: 5233 (Estimated)
Location: Locations are taken from Topographic Dgn
Coordinates: N: E:

Ground Water Notes:

Depth	▽ 17.0 ft	-	-	-
Date	12/7/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.4 ft. CONCRETE, 5 inches.	
								0.4 - 1.0 ft. ROAD BASE, 7 inches.	
								1.0 - 3.0 ft. sandy CLAY FILL,with some silt, black, stiff.	
								3.0 - 4.0 ft. gravelly SAND FILL, black, medium dense.	
	5				3/4/5	9		**4.0 - 8.0 ft. clayey SAND** with some gravel, brown, loose.	MC= 23 % #200= 40 % LL= 48 PL= 19 PI= 29 AASHTO: A-7-6 (6) USCS: SC
								8.0 - 27.0 ft. sandy CLAY, brown, stiff to very stiff, rust stains.	
	10				5/7	12			MC= 30.1 % DD= 91.1 pcf S/C= -0.2 %
	15				10/13	23			MC= 26 % DD= 97.4 pcf #200= 79 % LL= 61 PL= 20 PI= 41 AASHTO: A-7-6 (33) USCS: CH
	20				10/15	25			MC= 42.7 % DD= 77.5 pcf
	25				8/12	20			MC= 30.9 % DD= 90.7 pcf
								27.0 - 39.0 ft. silty SAND, brown, medium dense.	
	30				7/16	23			MC= 27.1 % DD= 96.5 pcf #200= 45 % LL= NV PL= NP PI= NP AASHTO: A - 4 (0) USCS: SM
					7/8	15			MC= 39 %

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW1**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
									DD= 80.6 pcf
					50:7"	50:7"		**39.0 - 40.5 ft. gravelly SAND** with silt, brown, very dense.	MC= 12.9 %
	40				80:11"	80:11"			
								Bottom of Hole at 40.5 ft.	MC= 7.1 % #200= 6 % LL= NV PL= NP PI= NP AASHTO: A-1-b (0) USCS: SP - SM
	45								
	50								
	55								
	60								
	65								
	70								
	75								

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW2**
Sheet 1 of 2

Boring Began: 12/2/2011
Drilling Method: Hollow-Stem Auger (8" O.D.)
Drill: Dietrich D-50 Rubber Track
Driller: Dakota Drilling
Logged By: B. Johnson
Final By: I. Chen
Inclination: Vertical

Completed: 12/2/2011
Drill Bit:
Casing:
Weather:

Total Depth: 75.2 ft
Ground Elevation: 5232 (Estimated)
Location: Locations are taken from Topographic Dgn
Coordinates: N: E:

Ground Water Notes:

Depth	▽ 30.0 ft	-	-	-
Date	12/2/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
								0.0 - 0.7 ft. ASPHALT, 8 inches.	
								0.7 - 6.0 ft. clayey SAND FILL, with some gravel, dark brown, medium dense.	MC= 14.1 % #200= 33 % LL= 35 PL= 17 PI= 18 AASHTO: A-2-6 (0) USCS: SC pH= 7.3 S= 0.058 % Re= 683 ohms-cm Cl= 0.0431 %
	5				11/8	19			
								6.0 - 14.0 ft. clayey SAND, brown, medium dense.	
	10				7/11	18			MC= 24.7 % DD= 92.1 pcf
								14.0 - 18.0 ft. sandy CLAY, brown, stiff.	
	15				5/6	11			MC= 25.3 % DD= 82.8 pcf
								18.0 - 23.0 ft. silty SAND, brown, medium dense.	
	20				7/9	16			MC= 17.3 % DD= 87.7 pcf #200= 41 % LL= NV PL= NP PI= NP AASHTO: A - 4 (0) USCS: SM
								23.0 - 36.0 ft. sandy CLAY, brown, stiff to hard.	
	25				7/8	15			MC= 28.9 % DD= 86.1 pcf #200= 70 % LL= 53 PL= 19 PI= 34 AASHTO: A-7-6 (22) USCS: CH
▽	30				5/6	11			MC= 42.7 % DD= 78.2 pcf #200= 89 % LL= 55 PL= 21 PI= 34 AASHTO: A-7-6 (33) USCS: CH

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: 8th Ave Wall at Weir Gulch
Project Number: 211-117 Date: 12/8/11

Boring: **YA-RW2**
Sheet 2 of 2

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
					7/43	50			
								36.0 - 65.0 ft. gravelly SAND with some silt, brown, medium dense to very dense.	
	40				23/50	73			MC= 11.9 % #200= 4 % LL= NV PL= NP PI= NP AASHTO: A-1-b (0) USCS: SP
	45				16/17/18	35			MC= 11.2 %
	50				9/10/12	22			
	55				10/11/12	23			MC= 11.3 %
	60				16/23/28	51			
	65				50:4"	50:4"		**65.0 - 75.2 ft. CLAYSTONE**, gray, very hard.	MC= 17.4 %
	70				50:3"	50:3"			
	75				50:2"	50:2"		Bottom of Hole at 75.2 ft.	

BORING LOG 211-117 RETAINING WALL BORINGS.GPJ YEH ASSOCIATES.GDT 9/6/12

YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project: Federal Blvd - 6th to Howard
Project Number: 211-117 Date:

Boring: **P-16**
Sheet 1 of 1

Boring Began: 8/31/2011
Drilling Method: Solid-Stem Auger
Drill: CME 45
Driller: Old Dirt Drilling
Logged By: T. Hansen
Final By: T. Hansen
Inclination: Vertical

Completed: 8/31/2011
Drill Bit:
Casing:
Weather:

Total Depth: 11.0 ft
Ground Elevation: 5240.7 ft
Location: 39 43.764, -105 01.517
Coordinates: N: 2,691,339.8 E: 6,134,314.6

Ground Water Notes:

Depth	▽ Dry	-	-	-
Date	8/31/11	-	-	-
Time	-	-	-	-

Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock RQD	Soil Samples Blows per 6 in	Soil Samples N	Lithology	Material Description	Field Notes and Lab Tests
5240								**0.0 - 1.0 ft. Asphalt Pavement** 12.25 inches.	
								1.0 - 4.5 ft. CLAY FILL CONTAMINATED: strong petroleum oder, brown - black, moist, medium dense.	MC= 16.7 % #200= 43 % LL= 45 PL= 15 PI= 30 R-Value= 6 AASHTO: A-7-6 (18) USCS: CL
					7/6	13			
	5							**4.5 - 11.0 ft. sandy CLAY FILL** with debris: brick, coal, and organics, gray mottled with brown, moist, stiff to very stiff.	
5235					9/9	18			
	10				6/7	13			
5230								Bottom of Hole at 11.0 ft.	

BORING LOG 211-117.GPJ YEH ASSOCIATES.GDT 10/11/11

Appendix C

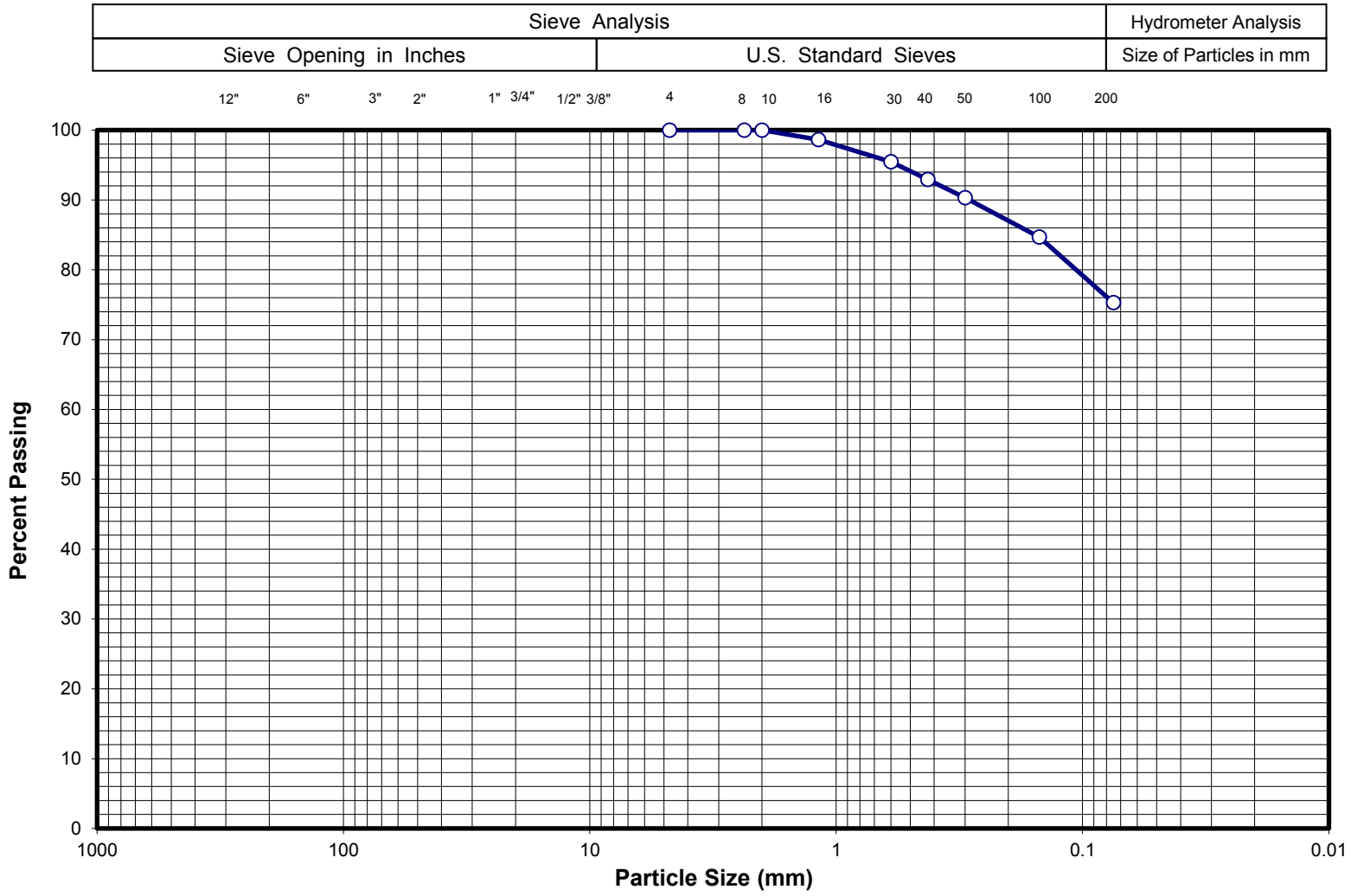
LABORATORY TEST RESULTS

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 216-457 Project Name: ES CCD Federal Blvd Pipe-Jacking Date: 1/6/2017

Sample Location			Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg			PH	Water Soluble Sulfate %	Resistivity ohm.cm	Chloride %	Unconfined Comp-Strength (psi)	CLASSIFICATION	
Boring No.	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI						AASHTO	USCS
YA-FED-1	10	CA	27.4	92.5	0	25	75	54	18	36	–	–	–	–	–	A-7-6 (26)	CH
YA-FED-1	15	CA	18.6	108.4	3	50	47	50	19	31	–	–	–	–	–	A-7-6 (10)	SC
YA-FED-1	20	CA	18.3	110.7	0	43	57	38	14	24	–	–	–	–	–	A-6 (10)	CL
YA-FED-2	10	CA	27.3	94.4	0	28	72	44	22	22	–	–	–	–	–	A-7-6 (15)	CL
YA-FED-2	15	CA	27.0	98.7	–	–	–	–	–	–	7.9	<0.001	1130	0.0022	–	–	–
YA-FED-2	20	CA	36.2	83.5	0	1	99	74	29	45	–	–	–	–	–	A-7-6 (53)	CH
YA-FED-3	5	CA	22.9	102.4	0	32	68	51	20	31	–	–	–	–	–	A-7-6 (20)	CH
YA-FED-3	10	CA	8.6	126.1	3	65	32	25	14	11	–	–	–	–	–	A-2-6 (0)	SC
YA-FED-3	15	CA	21.4	99.9	–	–	–	–	–	–	7.8	0.008	2079	0.0016	–	–	–
YA-FED-3	20	CA	14.4	–	3	78	19	NV	NP	NP	–	–	–	–	–	A-1-b (0)	SM
YA-FED-3	25	CA	13.3	124.6	2	79	19	27	18	9	–	–	–	–	–	A-2-4 (0)	SC



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	100
#10	100
#40	93
#200	75

Gravel (%)	0	LL	54	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	25	PL	18	Sample ID:	YA-FED-1
Fines (%)	75	PI	36	Sample Depth (ft.):	10
Sample Description:	**A-7-6 (26) / CH**				

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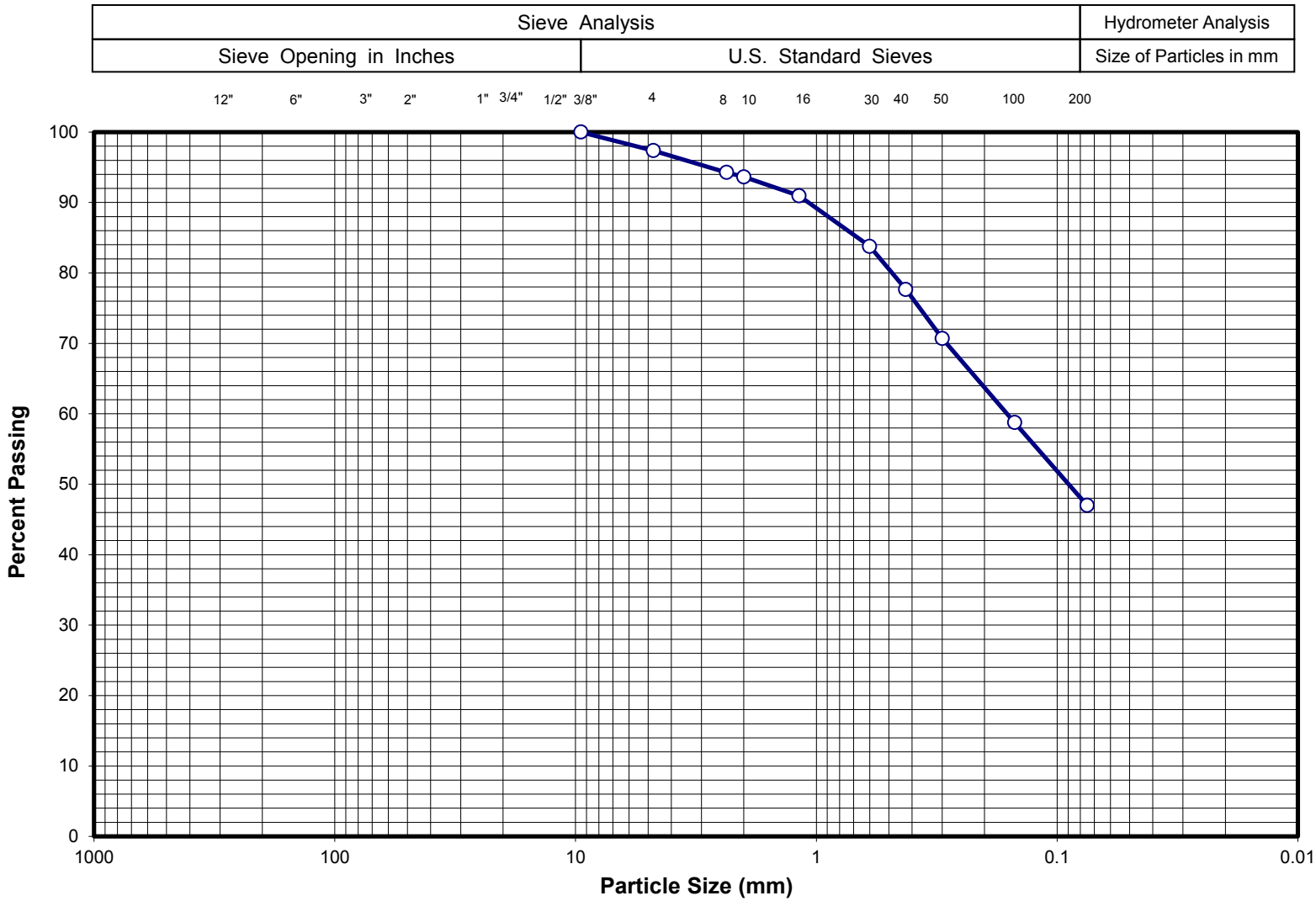
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	97
#10	94
#40	78
#200	47

Gravel (%)	3	LL	50	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	50	PL	19	Sample ID:	YA-FED-1
Fines (%)	47	PI	31	Sample Depth (ft.):	15
Sample Description:	**A-7-6 (10) / SC**				

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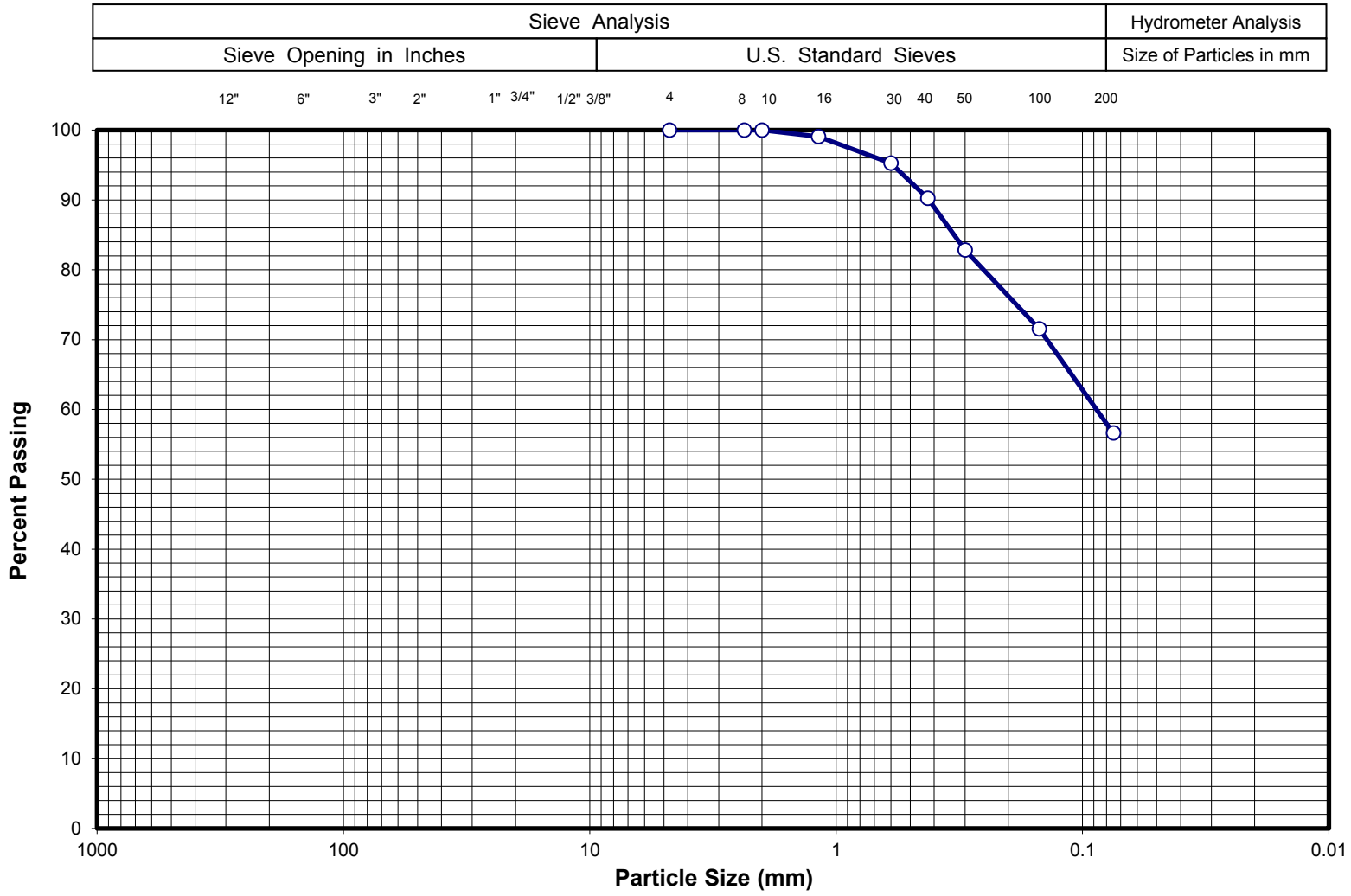
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	100
#10	100
#40	90
#200	57

Gravel (%)	0	LL	38	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	43	PL	14	Sample ID:	YA-FED-1
Fines (%)	57	PI	24	Sample Depth (ft.):	20
Sample Description:	**A-6 (10) / CL**				

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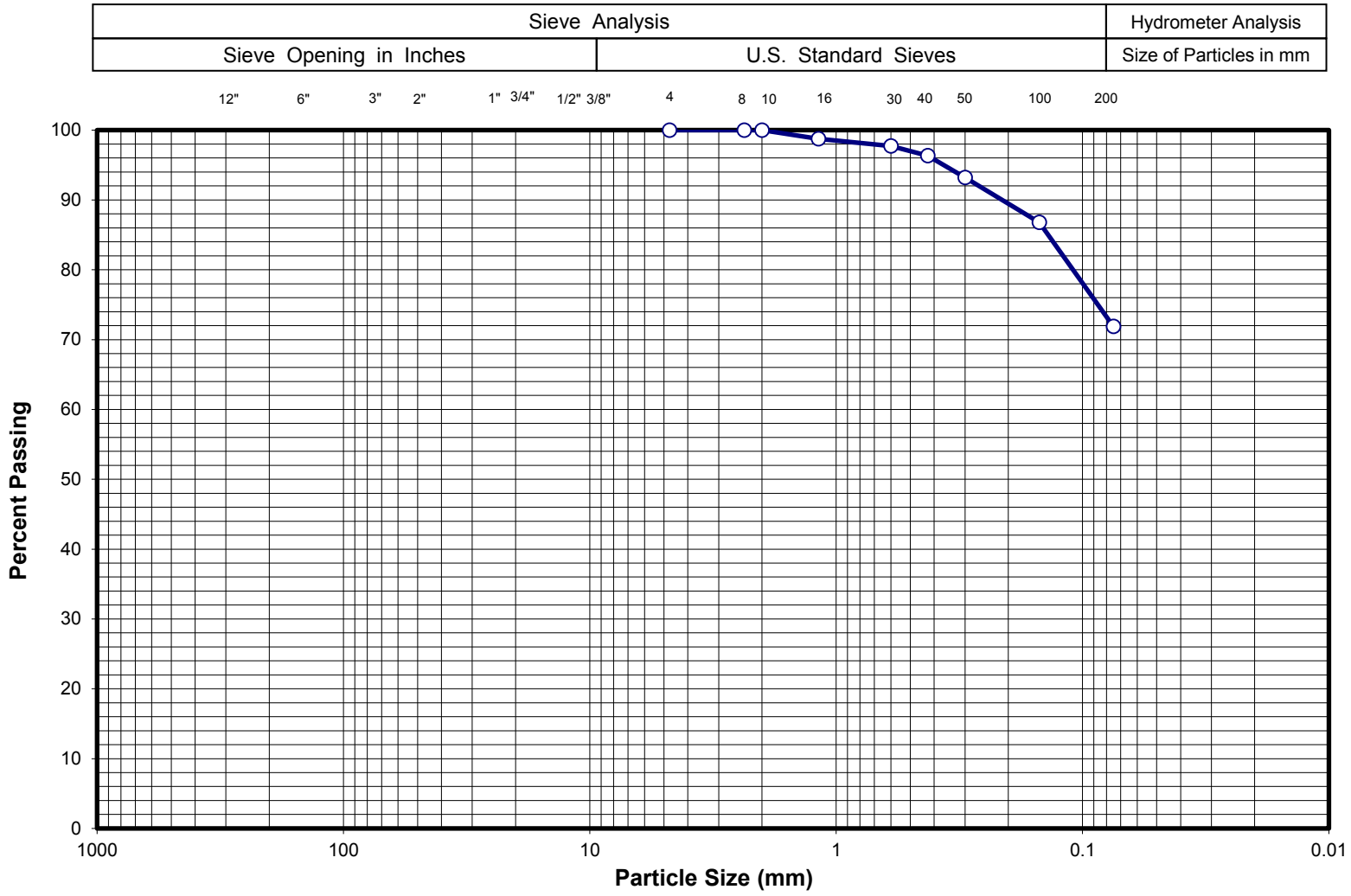
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	100
#10	100
#40	96
#200	72

Gravel (%)	0	LL	44	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	28	PL	22	Sample ID:	YA-FED-2
Fines (%)	72	PI	22	Sample Depth (ft.):	10
Sample Description:	**A-7-6 (15) / CL**				

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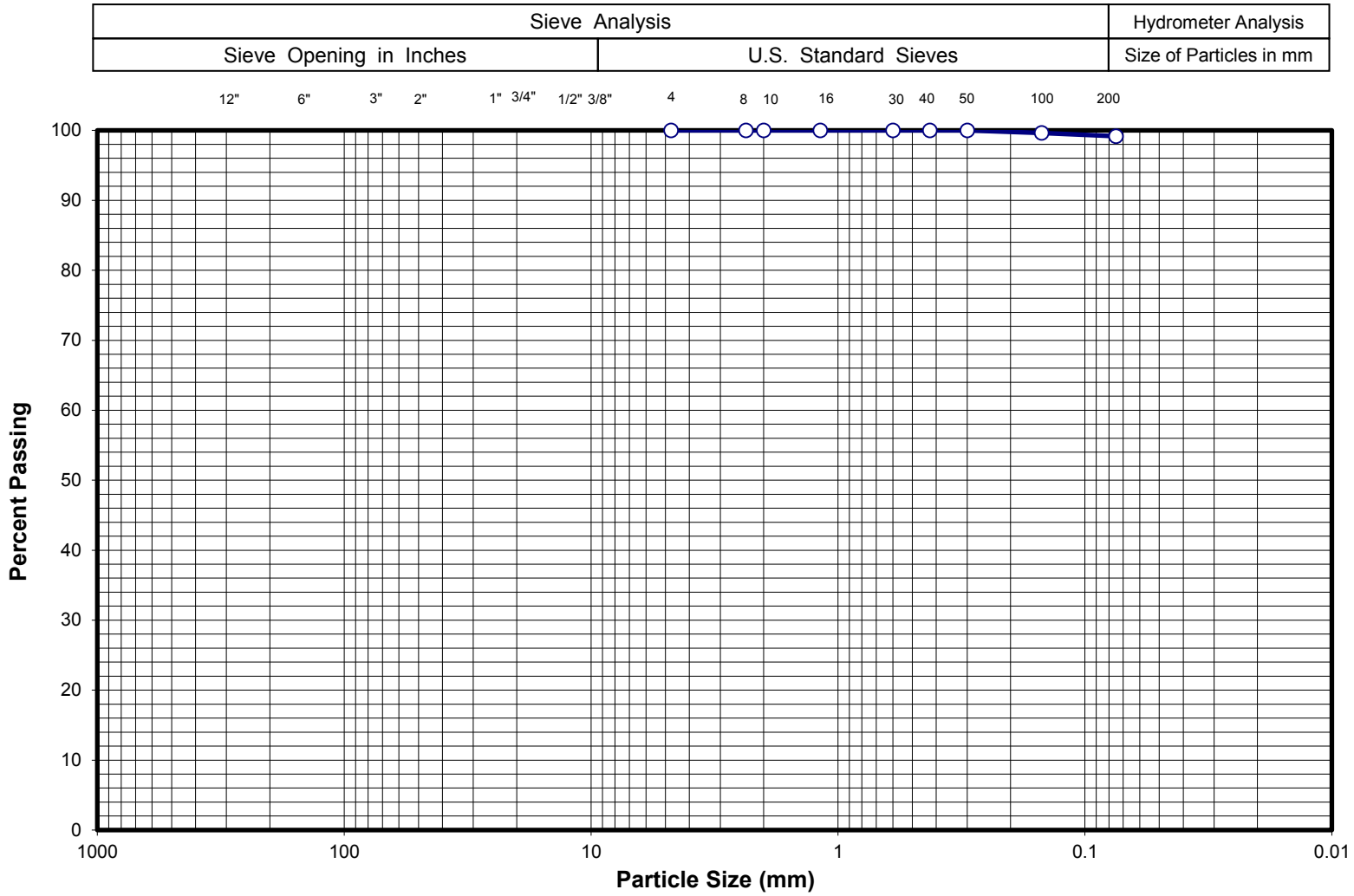
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	100
#10	100
#40	100
#200	99

Gravel (%)	0	LL	74	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	1	PL	29	Sample ID:	YA-FED-2
Fines (%)	99	PI	45	Sample Depth (ft.):	20
Sample Description:	**A-7-6 (53) / CH**				

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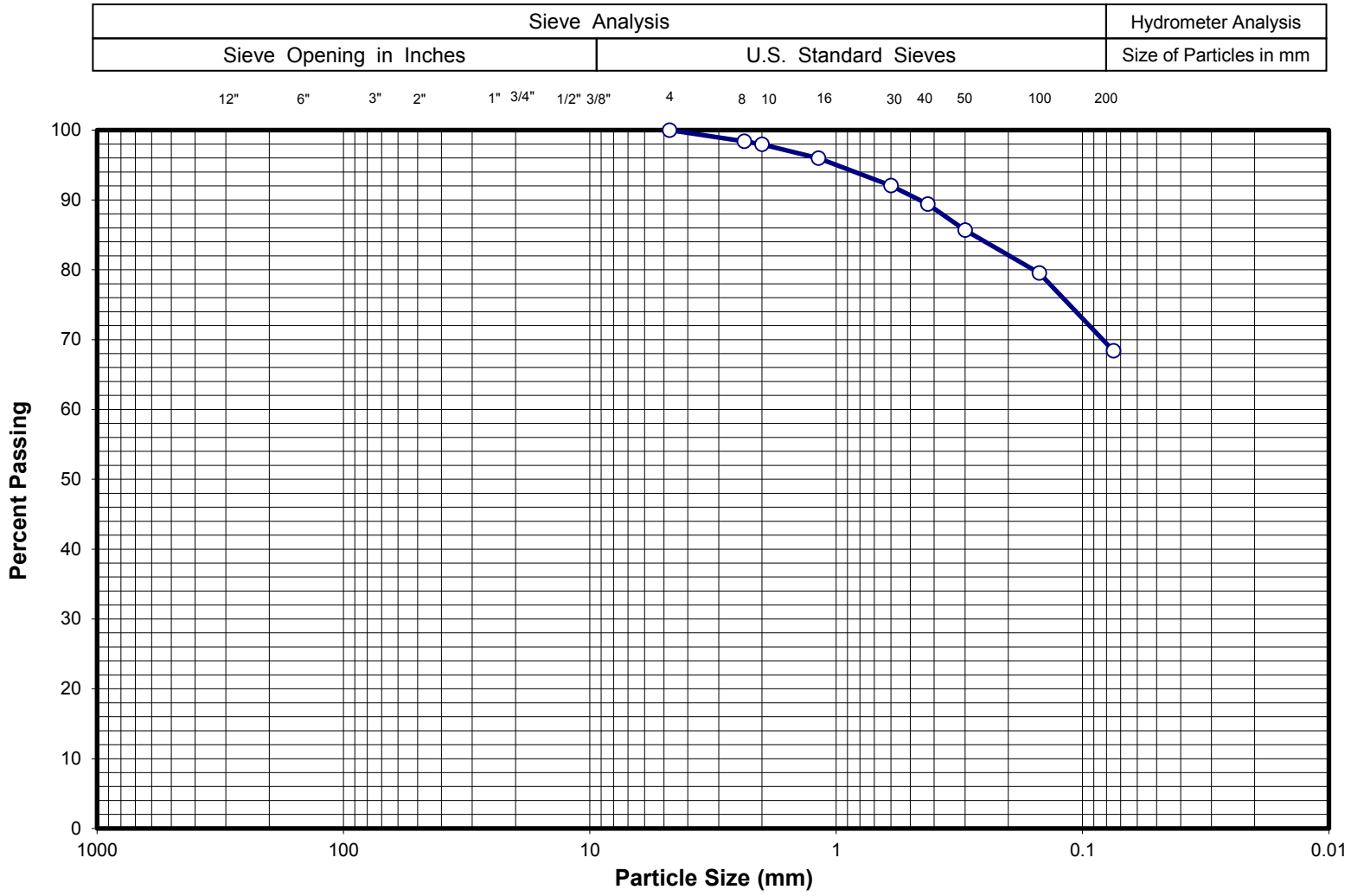
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	100
#10	98
#40	89
#200	68

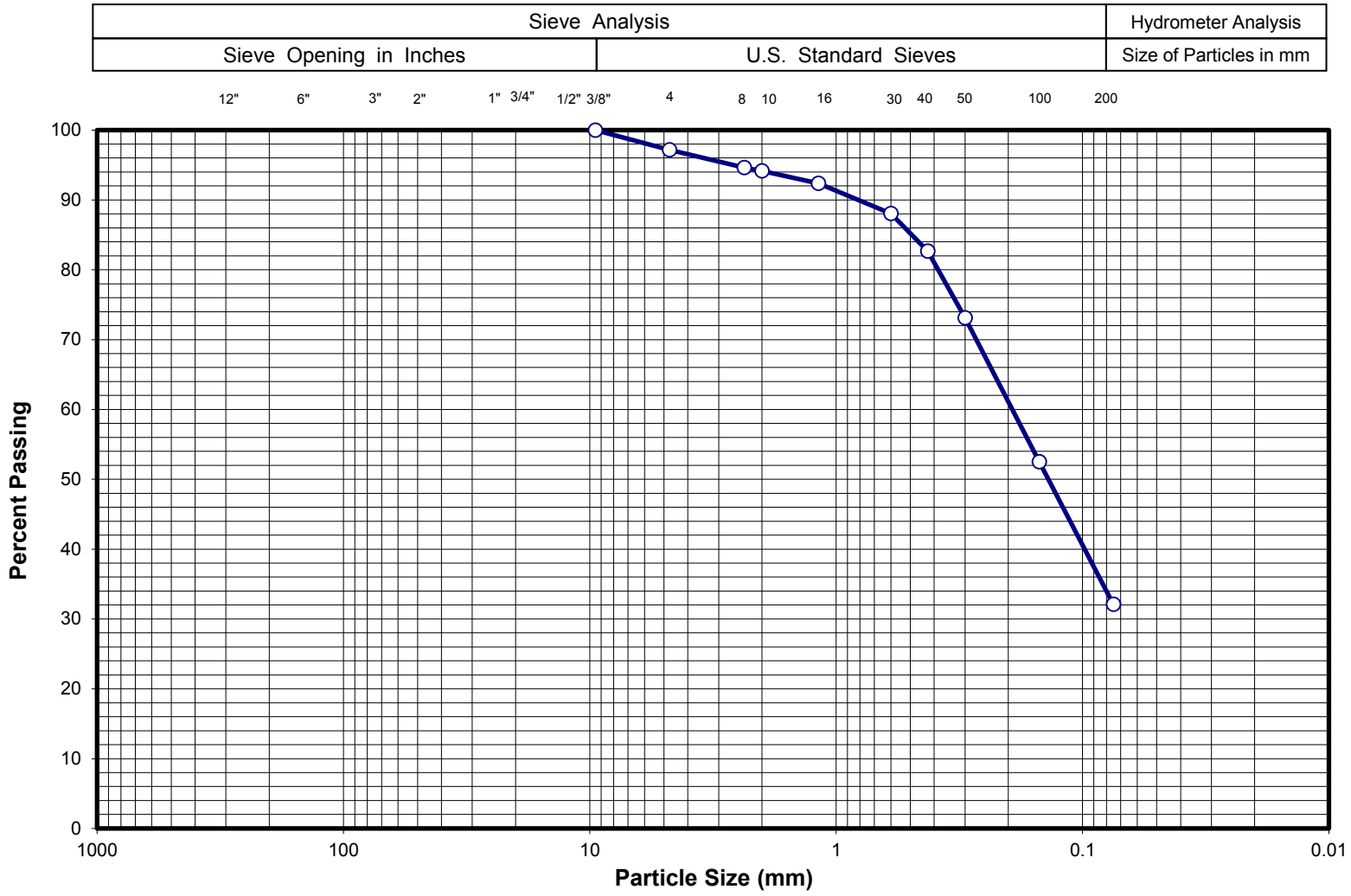
Gravel (%)	0	LL	51	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	32	PL	20	Sample ID:	YA-FED-3
Fines (%)	68	PI	31	Sample Depth (ft.):	5
Sample Description:	**A-7-6 (20) / CH**				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	97
#10	94
#40	83
#200	32

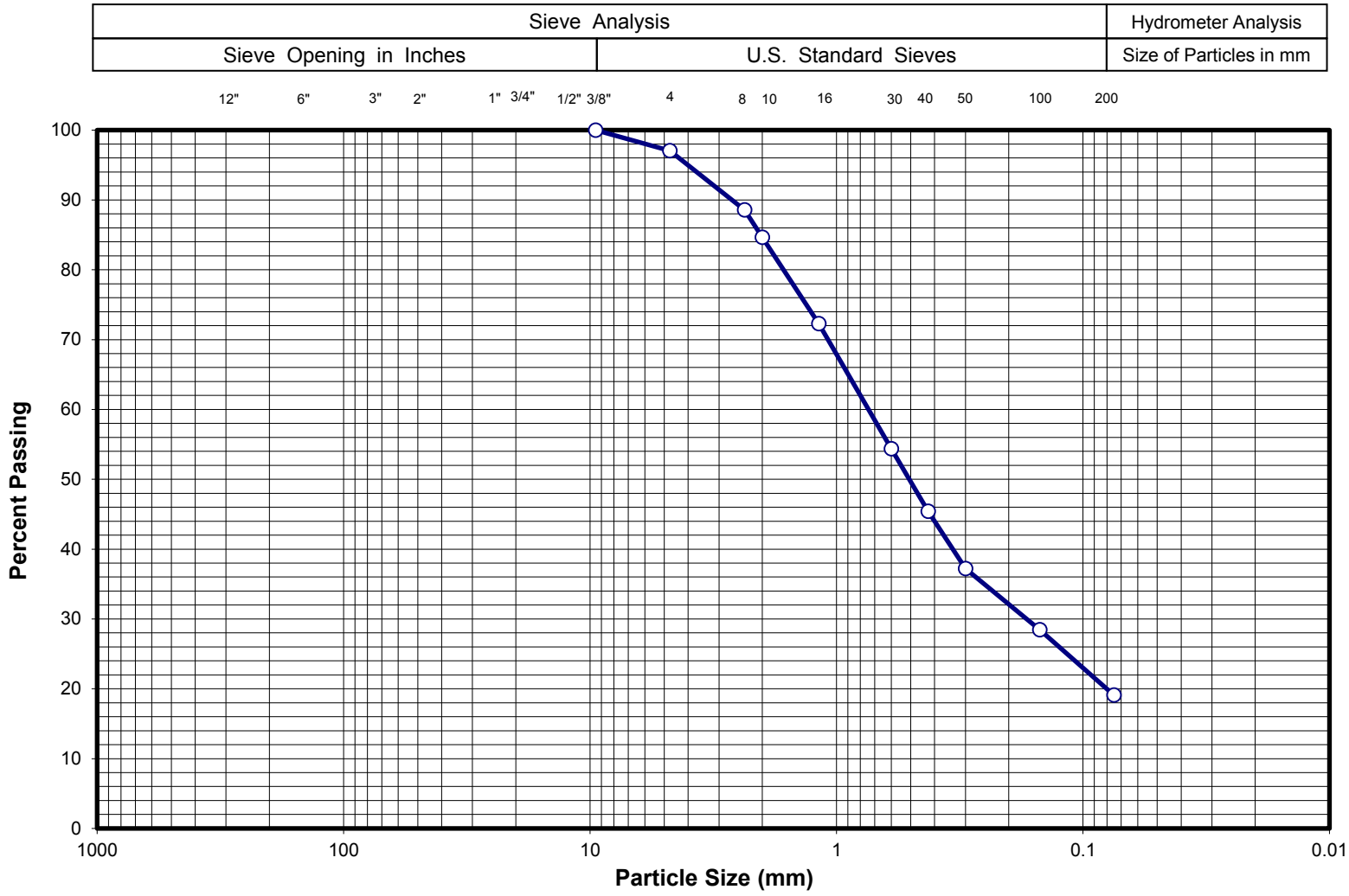
Gravel (%)	3	LL	25	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	65	PL	14	Sample ID:	YA-FED-3
Fines (%)	32	PI	11	Sample Depth (ft.):	10
Sample Description:	**A-2-6 (0) / SC**				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	97
#10	85
#40	45
#200	19

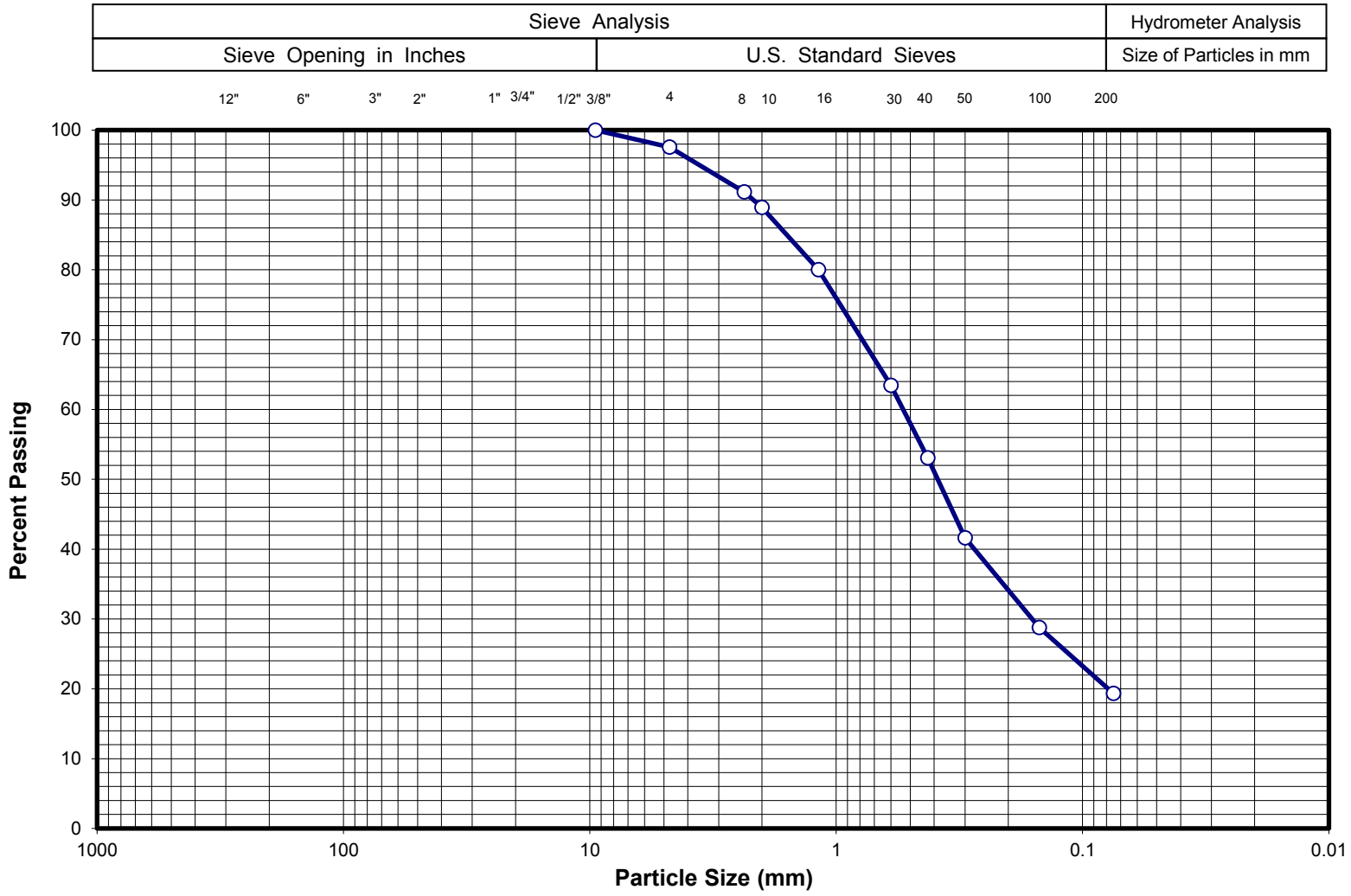
Gravel (%)	3	LL	NV	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	78	PL	NP	Sample ID:	YA-FED-3
Fines (%)	19	PI	NP	Sample Depth (ft.):	20
Sample Description:	**A-1-b (0) / SM**				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/06/17	Figure No.:	-

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	98
#10	89
#40	53
#200	19

Gravel (%)	2	LL	27	Project Name:	ES CCD Federal Blvd Pipe-Jacking
Sand (%)	79	PL	18	Sample ID:	YA-FED-3
Fines (%)	19	PI	9	Sample Depth (ft.):	25
Sample Description:	**A-2-4 (0) / SC**				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	216-457
Checked By:	H.H		
Date:	01/09/17	Figure No.:	-

Revised 04/27/2004

Appendix G

Tunnel Feasibility Report
Federal Boulevard Storm Sewer Tunnel
Denver, Colorado

February 17, 2017

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Excellence. Innovation. Service. Value.
Since 1954.

Submitted To:
Yeh and Associates, Inc.
2000 Clay Street, Suite 200
Denver, Colorado 80211

By:
Shannon & Wilson, Inc.
1321 Bannock Street, Suite 200
Denver, Colorado 80204

23-1-01588-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

February 17, 2017

Yeh and Associates, Inc.
2000 Clay Street, Suite 200
Denver, Colorado 80211

Attn: Mr. Howard Hume, Ph.D., P.G.

RE: TUNNEL FEASIBILITY REPORT, FEDERAL BOULEVARD STORM SEWER TUNNEL, DENVER, COLORADO

Shannon & Wilson, Inc. is pleased to submit this Tunnel Feasibility Report for the subject project. We have evaluated the subsurface conditions along the proposed tunnel alignment in terms of the feasibility of alternative trenchless pipeline construction methods. Recommended methods of construction include hand mining with a shield or open face tunnel boring machine (TBM).

We have identified the technical difficulties associated with each construction method, along with potential risks to successful project completion. Our recommendations for construction are provided, along with a range of potential tunneling costs.

We appreciate the opportunity to be of service to you on this project. If you have any questions or require further information, please contact me at 303-825-3800.

Sincerely,

SHANNON & WILSON, INC.

Margaret A. (Peggy) Ganse, P.E., P.G.
Senior Associate

MAG:GRF/lmr

Encl: Tunnel Feasibility Report

23-1-01588-001_L2/wp/lmr

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TUNNEL FEASIBILITY REPORT
FEDERAL BOULEVARD STORM SEWER TUNNEL
DENVER, COLORADO

1.0 INTRODUCTION

1.1 Purpose of Report

The purpose of this report is to evaluate the feasibility of constructing a trenchless pipeline crossing associated with the Federal Boulevard Reconstruction Project from 5th Avenue to Howard Place, a joint project between the City and County of Denver (CCD) and the Colorado Department of Transportation (CDOT) (the Owners) to replace a storm sewer along Federal Boulevard in Denver, Colorado. Construction feasibility is based on ground conditions expected along the alignment in conjunction with pipeline characteristics/requirements and site constraints. For the purposes of this report, the terms "tunnel" and "trenchless" have been used interchangeably.

Shannon & Wilson, Inc. (Shannon & Wilson) has relied on boring logs and laboratory data provided by Yeh and Associates, Inc. (Yeh) in the Geotechnical Data Report (GDR) for subsurface information (Yeh, 2017). Project parameters are as shown in design plans prepared by designer Tsioiuvaras Simmons Holderness, Inc. (TSH) (TSH, 2016a). Our services were conducted in general accordance with our Agreement for Consulting and Professional Services with Yeh, dated December 2, 2016.

Shannon & Wilson has evaluated the subsurface conditions along the alignment in terms of the potential feasibility of alternative tunneling methods. We have identified the technical difficulties associated with various construction methods, along with potential risks to successful project completion. Our recommendations for construction are provided, along with a range of potential tunneling costs, so that CDOT, CCD, and the design team have sufficient information available to decide how to proceed with the tunneling portion of the project.

1.2 Project Description

The proposed tunnel crossing is located at the intersection of Federal Boulevard and 8th Avenue (Figure 1). The tunnel alignment parallels 8th Avenue along the north side of the westbound lane. The tunnel will cross under Federal Boulevard and span approximately 74.5 feet, connecting at each end to open cut pipeline trenches east and west of the intersection (TSH, 2016a). A jacking pit will be constructed at the eastern end of the tunnel with a receiving pit at

the western end. Jacking pit dimensions are estimated to be 40-feet long by 15-feet wide; receiving pit dimensions are estimated to be 20-feet long by 15-feet wide. The approximate tunnel and pit locations are shown in Figure 2.

The tunnel will consist of 54-inch inside diameter (I.D.) Class V reinforced concrete pipe (RCP). No steel casing pipe is planned for the tunnel. The tunnel will be constructed with a 0.50 percent grade downslope to the east. Soil cover over the crown of the tunnel will range from approximately 8 feet to 10 feet, greater than or equal to about 1.5 tunnel diameters of cover.

The tunnel alignment is located in a developed urban corridor and will cross beneath several buried utilities, including an 8-inch I.D. water line (unspecified material), 24-inch I.D. steel water line, 36-inch I.D. concrete water line, 12-inch I.D. PVC sanitary sewer line, 4-inch I.D. steel natural gas line, and multiple telecommunication lines. Based on design plans, the sanitary sewer and the 24-inch I.D. and 36-inch. I.D. water lines are located about 2 to 3 feet above the crown of the tunnel (TSH, 2016b). In addition, overhead traffic signal poles and lighting are located at both the northwest and northeast corners of the intersection.

2.0 SUBSURFACE CONDITIONS

2.1 Subsurface Explorations

Yeh performed a subsurface investigation along the tunnel alignment in January 2017, the scope of which included drilling of three geotechnical borings (designated YA-FED-1, YA-FED-2, and YA-FED-3) and subsequent laboratory testing of soil samples (Yeh, 2017); this report is referred to as the GDR. The GDR also includes boring logs for three additional borings drilled by Yeh in the project vicinity during previous phases of work (borings YA-RW1, YA-RW2, and P-16). Approximate boring locations are shown in Figure 2, including a boring drilled by Pinyon Environmental Consultants, Inc. (Pinyon) as part of a Phase II Environmental Site Assessment (boring RW14SB02) (Pinyon, 2016a).

Baseline soil and groundwater conditions are described in the Geotechnical Baseline Report (GBR) for the project (Shannon & Wilson, 2017), and are graphically delineated in the Construction Drawings. In general terms, soil conditions along the tunnel alignment and within the pit excavations are expected to consist of Fill, Suspect Fill, and Alluvium. These soil types are expected to consist of stiff to very stiff cohesive soils exhibiting firm ground behavior, and medium dense to dense granular soils exhibiting slow raveling to firm ground behavior, in accordance with the Tunnelman's Ground Classification System (Heuer, 1974). Debris (bricks, coal, nails, wood, etc.) and cobbles are expected in these soils. Bedrock and groundwater are not

expected to be encountered in the pit or tunnel excavations. This Section is intended only as a general summary of subsurface conditions and should not be used as a basis for planning or bidding the work; refer to the GBR and Construction Drawings for baseline conditions.

2.2 Environmental Considerations

While drilling boring P-16, a strong petroleum odor was noted in the soil samples from 1 to 4.5 feet below ground surface. Petroleum odors were also noted during drilling of boring YA-FED-3 from 1 to 31 feet. Both borings are located near the proposed receiving pit location.

While drilling boring YA-FED-3, Pinyon field screened samples using a photoionization detector (PID) and collected a soil sample for analytical testing. Metals and polycyclic aromatic hydrocarbons were detected in the sample but at concentrations below the EPA's regional screening levels for residential and industrial soil.

Pinyon has prepared a Materials Management Plan (MMP) for the project, which outlines handling and disposal of contaminated materials and other suspect materials which might be encountered during site excavation, including "petroleum-impacted soils and subsurface urban fill material/buried building material" (Pinyon, 2016b).

3.0 TUNNELING METHODS

3.1 Project Challenges

As described in Section 2.0, expected soil conditions along the alignment include stiff to very stiff cohesive soils exhibiting firm ground behavior and medium dense to dense granular soils exhibiting slow raveling to firm ground behavior. Most of the expected soil conditions will consist of Fill or Suspect Fill, along with Alluvium. Both Fill and Suspect Fill soils have special handling protocols related to the potential for environmental contamination. In addition, debris is expected in Fill and Suspect Fill.

As described in the GBR, only Suspect Fill and Alluvium are expected in the tunnel. These soil conditions present several challenges for tunneling, including: 1) the potential for settlement of overlying utilities; 2) the potential for environmental contamination in Suspect Fill; and 3) the potential for debris and/or cobbles in Suspect Fill and Alluvium. Each of these concerns is discussed below.

3.1.1 Settlement of Utilities

The shallow utilities located above the proposed tunnel are of concern for this project. There is on the order of only 2 to 3 feet of soil cover between the tunnel and the 12-inch I.D. PVC sanitary sewer, the 24-inch I.D. steel water line and the 36-inch. I.D. concrete water line based on plans. The depth of the pipe trench for these utilities is unknown, as is the type of pipe bedding and trench backfill material used during utility construction.

Estimated ground settlement for the stiff to very stiff cohesive soils is less than 0.20 inch at the ground surface, and 0.30 inch at the ground surface for the dense to very dense granular soils. These estimates assume that the contractor can maintain close control of the ground and experience no more than 1 percent ground loss, which should be achievable given the anticipated slow raveling to firm ground behavior during tunnel excavation. However, if unanticipated softer/looser soils are encountered such that fast raveling or running ground behavior is experienced, maintaining control of the ground will be more challenging. Thus, ground loss at the tunnel face may be greater, leading to increased ground settlement. For this reason, instrumentation and monitoring of the utilities is recommended.

3.1.2 Environmental Contamination in Suspect Fill

As described in the MMP, Suspect Fill has the potential for containing "petroleum-impacted soils and subsurface urban fill material/buried building material" (Pinyon, 2016b). The MMP describes protocols to be followed when excavating in Suspect Fill, including visual monitoring, field screening, stockpiling, sampling, and disposal of these materials based on their potential constituents of concern. To follow these protocols, the contractor must be able to see the soil as it is excavated and field screen and/or sample soils in situ if warranted.

For this reason, closed-face tunneling methods, such as microtunneling, are not considered appropriate for the project. In this method of tunneling, excavated soil is removed from the face of the microtunnel via slurry hoses and is later separated from the slurry in a separation plant. The face of the tunnel excavation is not visible or accessible in this method of tunneling, and the characteristics of the excavated soil are obscured by the slurry in which it is transported.

3.1.3 Debris and/or Cobbles in Suspect Fill and Alluvium

Debris such as bricks, coal, nails, and wood were observed in Suspect Fill during the subsurface exploration program (Yeh, 2017). In addition, cobbles were observed in Suspect Fill

during the subsurface investigation (Yeh, 2017) or were cited as a baseline component of Alluvium based on engineering judgment (Shannon & Wilson, 2017).

While this debris is not anticipated to impact tunneling productivity or equipment wear, certain types of debris and obstructions (e.g. large concrete blocks, railroad ties, nested cobbles) can pose a challenge for tunneling, as the materials cannot be readily "ingested" by tunnel equipment. If such unanticipated debris is encountered, the obstruction could halt the advancement of the tunnel. Worst case, an emergency shaft would need to be excavated in front of the tunneling machine to remove the obstruction.

3.2 Feasible Tunnel Construction Methods

Based on the need to accommodate potentially contaminated soils and unanticipated debris, closed-face tunneling methods (i.e. microtunneling) which do not allow the contractor access to the face are not considered appropriate for this project. We recommend the use of open-face tunneling methods which allow the contractor access to the face of the tunnel to manually remove obstructions and screen environmental materials. Based on the project challenges described above, there are two methods of open-face tunnel excavation that we consider feasible for this project: 1) hand mining with a shield; and 2) pipe jacking using a tunnel boring machine. A brief discussion of each method is provided below, along with our opinion of suitability for this project.

3.2.1 Hand Mining with a Shield

Ground conditions along the alignment are conducive to tunneling by hand mining. Hand excavation of tunnels can be accomplished in a number of ways and in combination with various tunneling and support systems. The main consideration is that the face of the tunnel be supported as required to maintain stability during the excavation process.

For this project, it is likely that excavation would be performed inside a simple shield fitted to the same O.D. as the Class V RCP jacking pipe. A shield is typically about 6- to 8-feet long, is equipped with an articulating head section, and features sand shelves at the leading edge which allow the contractor to provide some control over the rate of excavation. The front of the shield is typically angled such that the top section extends farther into the excavation than does the rest of the shield, providing additional support at the crown of the tunnel. Excavation would likely be performed by one or two miners inside the shield using hand tools or pneumatic clay spades and shovels. Due to the potential for petroleum-contaminated soils, the contractor will

likely incorporate ventilation and require some level of PPE for workers. Excavated soil is removed from the tunnel using a muck cart or small conveyor.

Once the shield has advanced its full distance, a section of pipe is lowered into the jacking pit and placed on the stationary launching guide rails. The pipe is then jacked into place using a jacking frame and hydraulic power pack to advance the jacks. The bell end of the pipe is jacked forward into the tail of the shield, and the excavation process begins again. This excavation and jacking process is repeated until the tunnel is completed.

Hand mining with a shield is a relatively conventional method of tunnel construction, and there are numerous local contractors with sufficient experience and equipment to bid the project using this method. For this reason, hand mining should be competitively priced. In addition, this method of tunneling allows access to the face of the excavation for monitoring of potentially contaminated soils and for removal of potential debris or obstructions. The mobilization costs for this method of tunneling are relatively low when compared to other more equipment-intensive methods, which is advantageous given the short length of tunnel and expected construction duration. An order of magnitude cost of $1,700/LF for hand tunneling can be used for estimating purposes.

3.2.2 Pipe Jacking with a Tunnel Boring Machine (TBM)

Ground conditions along the alignment are also conducive to conventional tunneling using an open-face tunnel boring machine (TBM). The TBM would consist of a full circular shield with a variety of configurations possible at the head of the machine. The machine could feature breasting plates which open and close similar to louvers or blinds, allowing the contractor to provide some control over the rate of excavation; this type of machine is commonly referred to as a "digger shield." Conventional excavation equipment, such as air spades, can be utilized to remove soils from the tunnel face. Alternatively, the machine could be equipped with a rotating cutter head to mechanically excavate the ground at the tunnel face. The pipe would be jacked into place concurrent with excavation.

Pipe jacking with a TBM is a relatively conventional method of tunnel construction, and there are numerous local contractors with sufficient experience and equipment to bid the project using this method. For this reason, pipe jacking should be competitively priced. Similarly, this method of tunneling will allow access to the face of the excavation for monitoring of potentially contaminated soils and for removal of potential debris or obstructions, depending on the configuration of the cutter head. The mobilization costs for this method of tunneling are

significantly higher than for hand mining, as the method relies on more sophisticated equipment and machinery. An order of magnitude cost of $2,600/LF for pipe jacking with a TBM can be used for estimating purposes. This higher unit rate reflects the mobilization cost.

4.0 RECOMMENDATIONS

We recommend that the project be designed to allow both hand mining with a shield and pipe jacking with a TBM, so that the market can determine the most cost competitive approach given contractor and machine availability at the time of bidding. Consistent with typical CDOT and CCD requirements, we recommend that the annulus between the pipe and the ground be contact grouted upon completion of tunneling.

We also recommend use of a geotechnical instrumentation and monitoring program to monitor ground movements along Federal Boulevard and along the 12-inch I.D. PVC sanitary sewer, the 24-inch I.D. steel water line and the 36-inch. I.D. concrete water line. We recommend two arrays of surface monitoring points placed at 5-foot center-to-center spacing be installed over the centerline of the tunnel. One of the arrays should be installed in one of the northbound lanes of Federal Boulevard and the other in one of the southbound lanes of Federal Boulevard. We understand that Federal Boulevard is paved with asphalt, therefore the monitoring points should be able to detect surface movement. The surface monitoring points will consist of a survey pin or marker affixed to the roadway surface. Utility monitoring points will consist of a steel rod embedded in a stiff grout placed onto the existing utility. A portion of the steel rod should be encased to allow the rod to move freely. The utility monitoring points should be protected with roadway boxes. Baseline elevations of the instruments should be obtained prior to beginning construction, then daily survey of each instrument within 50 feet of the working face of the tunnel should be made by the contractor and reported to CCD and CDOT. This monitoring distance applies to instruments in advance of the tunnel heading as well as those instruments which have already been passed by tunneling operations.

5.0 LIMITATIONS

This report was prepared for the exclusive use of the City and County of Denver, the Colorado Department of Transportation, and the design team for specific application to design of the project at this site as it relates to the geotechnical and tunneling aspects discussed herein. Within the limitations of the scope and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied.

SHANNON & WILSON, INC.

Margaret A. (Peggy) Ganse, P.E., P.G.
Senior Associate

MAG:GRF:/lmr

6.0 REFERENCES

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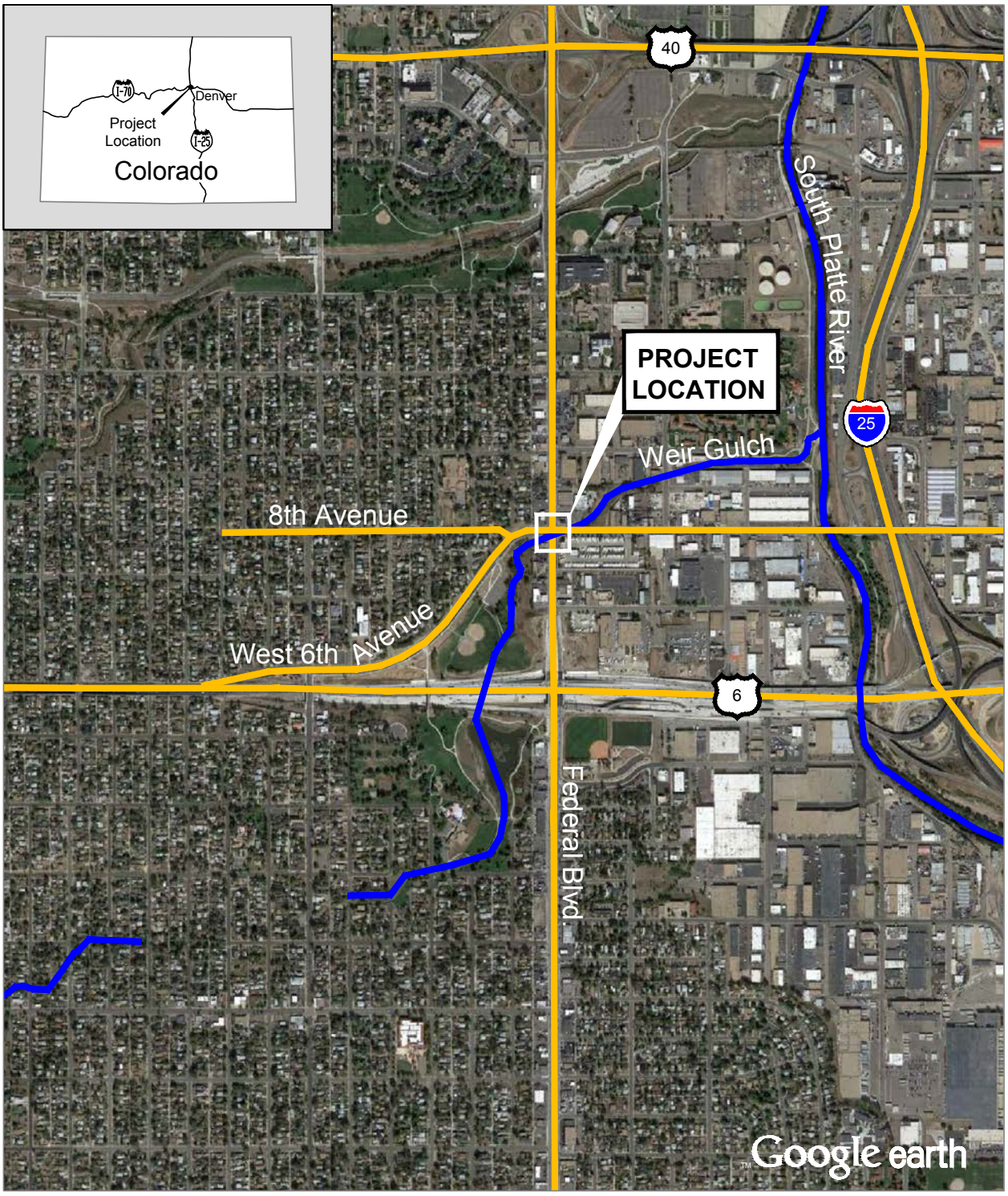

0 0.25 0.5

Approximate Scale in Miles

NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.

Federal Storm Sewer Tunnel
Tunnel Feasibility Report
Denver, Colorado

VICINITY MAP

February 2017 23-1-01588-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1

Filename: I:\EF\23-1 DEN\01500s\01588 Federal Storm Tunnel\Drafting\01588-001_F1.dwg Date: 01-30-2017 Login: dkm

LEGEND

YA-FED-1 Yeh and Associates, Inc. Boring Designation and Approximate Location

RW14SB02 Pinyon Environmental, Inc. Boring Designation and Approximate Location

0 30 60

Approximate Scale in Feet

NOTES

1. Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.
2. Boring locations are approximate. See geotechnical reports by Yeh and Associates, Inc. for surveyed locations (Yeh, 2012; Yeh, 2016; Yeh, 2017)
3. The proposed tunnel location shown is approximate. See final construction drawings for actual location, dimensions, and stationing.
4. The limits of the jacking and receiving pits shown are approximate. See final construction drawings for the maximum dimensions and locations allowed for this project.

Federal Storm Sewer Tunnel
Tunnel Feasibility Report
Denver, Colorado

SITE AND EXPLORATION PLAN

February 2017 23-1-01588-001

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2

Filename: I:\EF\23-1 DEN\01500s\01588 Federal Storm Tunnel\Drafting\01588-001_F2.dwg Date: 01-31-2017 Login: dkm

Appendix H

Special Notice to Contractors - 17

1. SCOPE

1.1 It is the intent of this chapter to provide guidelines to the Contractor or Sub-Contractor, so that they can properly present their materials for inclusion in the construction project.

1.2 The Contractor shall follow the procedures listed below to ensure the proper inspection, sampling, testing, and certification of materials and products incorporated into all construction projects.

1.3 "Prequalification of Bidders" (Standard Specifications, Subsection 102.01) is synonymous with any reference to the CDOT "Pre-Qual List". A Prime Contractor requiring additional information regarding bidding can go to https://www.codot.gov/business/bidding .

1.4 The Qualified Manufacturers List (QML) is used for suppliers of Steel Reinforcing Bars & Steel Dowel Bars, Epoxy-Coated Steel Reinforcing Bars & Epoxy-Coated Steel Dowel Bars, and Precast Concrete Structures. These products are required to be selected off the QML. All relevant details for the proper submittal of specified Standard Manufactured Materials and Fabricated Structural Materials are found in CDOT's Field Materials Manual under CP 11, Quality Management Plans for the Qualified Manufacturers List or the Approved Products List.

2. PROVIDE NOTIFICATION OF MATERIALS SOURCES AND SUPPLIERS

2.1 In accordance with Subsection 106.01 of the Standard Specifications: The Contractor shall submit a formal list of material sources and suppliers to the Engineer at least two weeks prior to delivery; however, it is preferable that the list be presented at the Pre-Construction Meeting. The Department will sample and test materials proposed by the Contractor to be utilized for Items 203, 206, and 304. If the Department test results indicate the material is not in conformance with the project specifications, the Contractor is directed to Subsection 106.02 regarding Contractor Source materials and additional testing requirements.

2.2 The list shall include: item to be supplied, quantity, a reference to the level of acceptance required by CDOT (per Section 7, Designated Products and Assemblies), company name and address supplying the material, and contact person (if the material is to be pre-inspected or if a problem exists with the material delivered). The submitted list shall indicate, immediately after the item being supplied, the applicable acceptance level required:

(A) Pre-Inspection (PI)
(B) Certified Test Report (CTR)
(C) Certificate of Compliance (COC)
(D) Pre-Approved (per APL)

2.3 All required product or material documentation shall be provided at the point and time of delivery to the construction project. Failure to provide the required documents, such as CTRs and COCs, may result in rejection of the materials. Failure to utilize the QML or APL may result in rejection of the materials.

3. INNOVATIVE CONTRACTING (DESIGN / BUILD PROJECTS, CM/GC PROJECTS, ETC.) - MATERIALS DOCUMENTATION RECORD, CDOT FORM #250

3.1 Two weeks before construction of any element of work the Contractor shall furnish the Engineer a schedule of items, approximate quantities to be incorporated into the project, and a reference to the method of acceptance required by CDOT (per Section 7, Designated Products and Assemblies). This information is to include the item of work with its placement location and dates. The Contractor shall immediately notify the Engineer, in writing, if the items of work or quantities are revised.

3.2 At the completion of the project, the Contractor shall furnish the Engineer with a completed CDOT Form #250 - Materials Documentation Record listing items utilized to construct the project and the approximate quantity of each item.

4. BUY AMERICA REQUIREMENTS

4.1 In accordance with Subsection 106.11 of the Standard Specifications as referenced in 23 CFR Part 635.410:

4.1.A Regulations require the use of domestic steel and iron in Federally funded construction projects. Buy America applies to construction components which are "predominately steel products," defined by CDOT as products which are manufactured with at least 80% steel or iron

content when delivered to the job site for installation. (See "C" below for examples.) CDOT provides waivers for manufactured products and products that are not predominately steel or iron. (See "D" below for examples.) Buy American strictly limits, but does not eliminate, the amount of foreign steel. (See "E" for minimum use & waiver information.)

4.1.B All manufacturing processes are defined as "processes required to change the raw ore or scrap metal into the finished, in-place steel or iron product". Manufacturing begins with the initial melting and mixing, and continues through the coating stage. Any process which modifies the chemical content, the physical size or shape, or the final finish is considered a manufacturing process.

4.1.C Examples of products that are subject to Buy America requirements include, but are not limited to, the following:

- steel or iron products used in pavements, bridges, tunnels or other structures, which include, but are not limited to, the following: fabricated structural steel, reinforcing steel, piling, high strength bolts, anchor bolts, dowel bars, permanently incorporated sheet piling, bridge bearings, cable wire/strand, pre-stressing / post-tensioning wire, motor/machinery brakes and other equipment for moveable structures;
- guardrail, guardrail posts, end sections, terminals, cable guardrail;
- steel fencing material, fence posts;
- steel or iron pipe, conduit, grates, manhole covers, risers;
- mast arms, poles, standards, trusses, or supporting structural members for signs, luminaires, or traffic control systems; and
- steel or iron components of precast concrete products, such as reinforcing steel, wire mesh and pre-stressing or post-tensioning strands or cables.

4.1.D Examples of products which are exempt from Buy America requirements include, but are not limited to, the following:

- products made of material other than steel or iron (aluminum, copper, brass, nickel, etc.);
- cabinets, covers, shelves;
- clamps, fittings, sleeves;
- washers, bolts, nuts, screws;
- tie wire, spacers;
- chairs;
- lifting hooks;
- faucets; and
- door hinges.

4.1.E Buy America will not prevent a minimal use of foreign steel or iron provided the total project delivery cost of all such steel and iron which includes the cost of delivering the steel and iron to the project, does not exceed one-tenth of one percent of the total contract cost or $2,500, whichever is greater. With prior concurrence from FHWA Headquarters, the FHWA Division Administrator may grant a waiver of the Buy America requirements for specific projects. When domestic steel products are available, meeting the contractor's schedule should not be the basis for requesting a Buy America waiver.

4.1.F The Contractor shall maintain on file at the project the certifications that every process, including the application of a coating, performed on steel or iron products either has or has not been carried out in the United States of America. These certifications shall create a chain of custody, and the lack of these certifications will be justification for rejection of the steel or iron product.

4.1.G Prior to the permanent incorporation into the project of all steel or iron product (domestic or foreign), the Contractor shall certify in writing to the Project Engineer that the delivered quantity of each material meets the contract Buy America requirements; that the original Buy America Certification from the Supplier is on file in the Contractor's project office; and the steel or iron products are in compliance with the plans and specifications for this project.

The Contractor shall maintain a document summarizing the date and quantity of the material utilizing CDOT's Item Number(s) and Item Description(s) delivered to the project, along with the quantity of material installed during the month. The Contractor shall provide documentation of the project delivered cost of all foreign steel or iron permanently incorporated into the project, if any. This summary shall be delivered to the Project Engineer on a monthly basis as established per the revision of Section 106.11 of the Standard Specifications for Road and Bridge Construction. A monthly summary shall be required even if no steel or iron products are incorporated into the project during the month. Examples of these requirements are shown on pages 12 thru 14 of this chapter.

NOTE 1: Section 106.11 of the CDOT Construction Manual contains specific

information on Buy America Requirements.

5. GLASS BEADS for PAVEMENT MARKING

5.1 The material shall meet the requirements of Standard Specifications Subsection 106.11, Section 627, and Subsection 713.08.

6. QUALITY MANAGEMENT PLANS FOR THE QUALIFIED MANUFACTURERS LIST OR THE APPROVED PRODUCTS LIST

6.1 CP 11 specifies requirements and procedures for a certification system that shall be applicable to all referenced manufacturers, as well as suppliers and contractors within certain industries. Certifying a Manufacturer's Quality Management Plan is not an automatic acceptance of any particular product, but an acknowledgement that the Manufacturer has taken steps to ensure that their quality controls meet the applicable Industry standards. Manufacturers whose Quality Management Plans are acceptable will be placed on the Qualified Manufacturers List (QML). Only Manufacturers listed on the QML will be eligible to provide the referenced products to a CDOT project.

6.2 The following Standard Manufactured Materials as referenced in CP 11 require an annual submission of a Quality Management Plan along with a sample for evaluation.

- Part I, Standard Manufactured Materials
  - Sub-Part 1. Asphalt Binder
  - Sub-Part 2. Asphalt Emulsion
  - Sub-Part 3. Hydraulic Cement
  - Sub-Part 4. Fly Ash
  - Sub-Part 5. Hydrated Lime

These products are located on the APL.

6.3 The following Fabricated Structural Materials as referenced in CP 11 require an annual submission of a Quality Management Plan.

- Part II, Fabricated Structural Materials
  - Sub-Part 1. Steel Reinforcing Bars & Steel Dowel Bars
  - Sub-Part 2. Epoxy-Coated Steel Reinforcing Bars & Epoxy-Coated Steel Dowel Bars
  - Sub-Part 3. Precast Conc. Structures

The QML is located within CDOT's Approved Products List (APL) web site, at www.codot.gov/business/APL . A Notice to Manufacturers is located within the same web site that references specific evaluation protocols including AASHTO's National Transportation Product Evaluation Program (NTPEP).

6.4 The respective QML web site pages are updated regularly. All pages will have at least one revision referencing acceptability for the new calendar year.

7. DESIGNATED PRODUCTS AND ASSEMBLIES

7.1 The majority of materials submitted for inclusion on CDOT projects will fall within one of four methods of product acceptance for their sampling and testing. CDOT always retains the right through its Quality Assurance (QA) Program to obtain samples for additional testing and require supplemental documentation.

7.2 If the material or product is not referenced within the four methods of product acceptance then the materials or products must be fabricated or supplied in accordance with the requirements of the applicable Colorado Department of Transportation specifications, plans, and standards. An example of processed materials not found in the following four methods are Aggregate Base Course (ABC), Hot Mix Asphalt (HMA), and Concrete (PCCP). An example of a manufactured product treated uniquely is the Dynamic Message Signs (DMS) which are competitively bid on projects or through state awards.

7.3.a. PRE-INSPECTION (PI):

Pre-Inspection is when representatives from the Colorado Department of Transportation visit a manufacturer's facility to perform an initial review of the company's quality control plan and employee certifications, as well as subsequent inspection visitations during the manufacturing of the product. Inspection arrangements shall be made by contacting the CDOT Staff Bridge Fabrication and Construction Inspectors at (303) 757-9339 a minimum of 10 days prior to the beginning of fabrication. Failure to give notification will result in delays to the project and/or rejection of materials or products.

NOTE 2: Bearing Devices and Expansion Devices are inspected randomly at the discretion of the Staff Bridge Fabrication Inspectors.

Products needing Pre-Inspection:

Bearing Devices (Type III) - Bridge[A]
Expansion Device, Modular - Bridge[A]
(0-6", through, 0-24")
Prestressed Concrete Units - Bridge[A]
Structural Steel - Bridge[A]

CDOT Form #193 is to be provided with the above referenced products.

7.3.b. CERTIFIED TEST REPORT (CTR):

The Certified Test Report method of acceptance is when a manufacturer is required to submit the actual test results performed on the material being provided. A CTR shall contain the actual results of tests for the chemical analysis, heat treatment, and/or mechanical properties per the drawing and/or specification. The contract will designate products and assemblies that can be incorporated in the work, if accompanied by Certified Test Reports. The word preceding the "Test Report" may vary between different industries, such as Certified, Mill, Metallurgical, Laboratory; however, they are all considered equivalent.

In accordance with Subsection 106.13 of the Standard Specifications and the requirements of this document, each CTR shall include:

1) Department's project number,
2) Manufacturer's name,
3) Address of manufacturing facility,
4) Laboratory name & address,
5) Name of product or assembly,
6) Complete description of the material,
7) Model, catalog, stock no. (if applicable),
8) Lot, heat, or batch number identifying the material delivered,
9) Date(s) of the laboratory testing,
10) All test results that are required so as to verify that the material furnished conforms to all applicable Department specifications. Test results shall be from tests conducted on samples taken from the same lot, heat, or batch.
11) The following certification, signed by a person having legal authority to act for the Contractor: [Example on page 6]

The Certified Test Report shall be a legible copy or an original document and shall include the Contractor's original signature. The signature (including corporate title) on the Certified Test Report, under penalty of perjury, shall be of a person having legal authority to act for the manufacturer or the independent testing laboratory. It shall state that the test results show that the product or assembly to be incorporated into the project has been sampled and passed all specified tests in conformity to the plans and specifications for this project. One legible copy or original document of the fully signed Certified Test Report shall be furnished to the Engineer prior to installation of the material. Failure to comply may result in delays to the project and/or rejection of the materials.

Each product or assembly delivered to the project must contain the lot, heat, or batch number identical to that on the accompanying Certified Test Report. Products or assemblies furnished on the basis of Certified Test Reports may be sampled and tested by the Department and if determined that the material does not meet the applicable specifications, the material will be rejected or accepted according to Subsection 105.03.

An example of what is required on a CTR is on page 15 of this chapter.

Products requiring Certified Test Report (below is an incomplete list):

- Bearing Devices (Type III) - Bridge[A]
- Bridge Deck Forms, Permanent Steel [A]
- Cribbing, Steel
- Geogrid (or COC, per project specs)
- Glass Beads (for pavement marking)
- Mechanical Fasteners (Field) [A]
- Overhead Sign Structures [A]
- Pedestrian & Bikeway Railing
- Quicklime
- Soil Conditioner
- Structural Plate Structures
- Top Soil
- Traffic Signal Structures [A]
- Water, Non-Potable
- Welded Wire Reinforcement

7.3.c. CERTIFICATE OF COMPLIANCE (COC):

The Certificate of Compliance method of acceptance is when a manufacturer is required to submit a document certifying that the material being provided meets all required Department specifications. A COC shall reference the required specifications for the chemical analysis, heat treatment, and/or mechanical properties per the drawing and/or specification, but not the actual test results. The contract will designate products and assemblies that can be incorporated in the work, if accompanied by Certificates of Compliance.

In accordance with Subsection 106.12 of the Standard Specifications and the requirements of this document, the certificate shall include:

1) Department's project number,
2) Manufacturer's name,
3) Address of manufacturing facility,
4) Laboratory name & address,
5) Name of product or assembly,

6) Complete description of the material,
7) Model, catalog, stock no.(if applicable),
8) Lot, heat, or batch number identifying the material delivered,
9) Date(s) of the laboratory testing,
10) Listing of all applicable specifications required by the Department for this particular product or assembly. Certificates shall reference the actual tests conducted on samples taken from the same lot, heat, or batch, and shall include a statement that the product or assembly to be incorporated into the project was fabricated in accordance with and meets the applicable specifications.
11) The following certification, signed by a person having legal authority to act for the Contractor: [Example on page 6]

The original Certificate of Compliance shall include the Contractor's original signature. The original signature (including corporate title) on the Certificate of Compliance, under penalty of perjury, shall be of a person having legal authority to act for the manufacturer. It shall state that the product or assembly to be incorporated into the project has been sampled and passed all specified tests in conformity to the plans and specifications for this project. One legible copy of the fully signed Certificate of Compliance shall be furnished to the Engineer prior to installation of material. The original shall be provided to the Engineer before payment for the represented item will be made.

Each product or assembly delivered to the project must contain the lot, heat, or batch number identical to that on the accompanying Certificate of Compliance. Products or assemblies furnished on the basis of Certificates of Compliance may be sampled and tested by the Department and if determined that the material does not meet the applicable specifications, the material will be rejected or accepted according to Subsection 105.03.

An example of what is required on a COC is on page 16 of this chapter.
NOTE 3: If the Plans do not specifically reference a Certified Test Report (Mill Test Report) and the product category is not listed on the Approved Products List within the Pre-Approved level of acceptance, then a COC will be required.

Products requiring Certificate of Compliance (below is an incomplete list):

AEP (Asphalt Emulsion Prime)
Aggregate Bag (for the bag, CTR for agg.)
Bearing Devices (Type I, II [A B])
Bridge Rail, Steel [A]
Catch Basin Insert
Cattle Guard Boxes, Pre-Cast
Concrete Box Culverts, Precast
Dampproofing, Asphalt
Delineator Posts, Steel
Ditch Control (Erosion Log & Silt Dike)
Dust Palliative, Asphaltic or Magnesium Chloride
Erosion Bales [D]
Expansion Joint Material, Preform. Filler
Fence (Wires & Posts)
Fertilizer
Flumes (all types) Gabions and Slope Mattress
Gaskets
Geogrid (for Erosion Control)
Glass Beads (for PMM)
Guard Rail - End Anchors
Guard Rail Metal [A]
Guard Rail Posts - Metal [A]
Guard Rail - Precast
Guard Rail Posts - Timber Blocks and Posts [A]
Hay [D]
Headgates
Hydraulic Soil Stabilizers
Inlets, Grates and Frames (Prefab)
Interior Insulation
Irrigation Systems
Lighting, all items
Light Standards, High Mast
Light Standards, Metal
Luminaires (Inclusive)
Manholes, Rings and Covers (Prefab)
MSE Wall - Elements [A,C]
Mulch (Hydraulic or Dry Applied)
Mulch Tackifier
Pedestrian Bridge [A]
Perimeter Control (Silt Fence)
Piling [A]
Pipes - all material compositions
Rest Area Materials (construction of)
Retaining Wall Blocks
Seeding (Native), Seed [C]
Sign Panels
Sprinkler System(s)
Steel Chairs
Steel Sign Posts
Steel Sheet Piling [A]
Storm Drain Inlet Protection
Straw [D]
Structural Glazed Tile and Ceramic Tile
Structural Plate Structures [A]
Structural Steel Galvanized [A]
Treated Timber
Vegetation (Sod & Plants)

Water, Potable
Water Control Devices

Water Lines
Welded Wire Mesh

NOTE 4:

A Mill Test Report shall be included.

B Certified Test Report(s) on components must accompany the material or product.

C Certified Test Report shall be included.

D Contractor may obtain a current list of Weed Free Forage Crop Producers by contacting the Colorado Department of Agriculture at (303) 239-4149.

Example of stamp or affixed sticker to be placed on Certified Test Reports (CTRs), per Subsection 7.3 B (11).

I hereby certify under penalty of perjury that the material listed in this Certified Test Report represents _____(quantity and units) of pay item _____ (pay item # and description) that will be installed in conformance with the plans and specifications on Project Number_____ .

_____ _____
Contractor Rep. Signature Date

Example of stamp or affixed sticker to be placed on Certificates of Compliance (COCs), per Subsection 7.3 C (11).

I hereby certify under penalty of perjury that the material listed in this Certificate of Compliance represents _____(quantity and units) of pay item _____ (pay item # and description) that will be installed in conformance with the plans and specifications on Project Number_____ .

_____ _____
Contractor Rep. Signature Date

7.3.d. PRE-APPROVED (APL):

The Pre-Approved method of acceptance is when a manufacturer is required to submit all relevant documentation on their product in advance of any specific project. A primary requirement to be considered for the Approved Products List (APL) is that the material retains a very high level of uniformity and consistency in its production quality (i.e. not project specific).

The submittal of Product literature /Tech Data Sheet (TDS), Certificates of Compliance, Certified Test Reports, Materials Safety Data Sheets (MSDS), etc., as well as product samples for specific categories combine all previous methods of acceptance into one. A Manufacturer whose product is not currently on the APL should read and follow the instructions within the Notice to Manufacturers on the APL web site at www.codot.gov/business/APL .

Product evaluation can take a minimum of four months to in excess of a year for some product categories. If CDOT specifications need to be altered or created for a product's acceptance then it could take even longer.

In accordance with CDOT's Procedural Directive 1401.1, a manufacturer's product is evaluated within CDOT to determine its acceptability on CDOT construction projects, as defined by CDOT specifications, plans and standards. For additional information on the APL or the web site contact the Product Evaluation Coordinator within the Staff Materials & Geotechnical Branch at 303-398-6566.

Locate products on the web site through *APL Search*, and then use the referenced Category, the Manufacturer's name, or the Product name. A category search requires that the drop-down menus be used.

APL User Guidance

1. If three or more products are listed for any applicable category then one of these products shall be selected. If the category is unpopulated a COC will be required for the product actually used. If the category is under-populated a COC will be required for the product actually used if not from the APL. CDOT's Subject Matter Expert (SME) for the applicable category shall be contacted for assistance. A CTR may be requested if the Project Engineer deems it appropriate. Contact the CDOT Product Evaluation Coordinator at 303-398-6566 with any questions.

2. Products that are evaluated on a batch or lot basis and subsequently posted on the APL web site will not be posted indefinitely. They expire two years after their CTR date or they will be removed sooner if informed that the batch or lot is depleted. Specifically this refers to (1) single component, hot-applied, elastomeric membranes for bridge decks, (2) hot poured, joint/crack sealant, and (3) asphalt plug joints.

3. Asphalt Binder and Asphalt Emulsions: Approved asphalt binders and emulsions are valid for the calendar year in which they were tested and approved, as per CP 11. The year is incorporated into the product name. On February 1st of each calendar year product older than two complete years will be automatically removed.

4. Environmental Erosion Control and Sediment / Pollution Control: All questions regarding this category's materials, both the current specifications and the products, should be directed to the CDOT Staff Environmental Branch SME.

5. Traffic Control Pavement Marking Material Sub-Category: All questions regarding pavement marking materials, both the current specifications and the products, should be directed the CDOT Staff Traffic Branch SME.

6. Geosynthetics and Geotextiles:
Materials Bulletin (2008 Number 1) dated January 25, 2008 is posted at:
http://www.codot.gov/Business/DesignSupport/Materials%20Bulletins/Materials%20Bulletins.htm

This Materials Bulletin clarifies the terminology and application of geosynthetics as specified in the standard specifications and the standard special provision (SSP), *Revision of Sections 208, 420, 605, and 712 – Geosynthetics and Geotextiles.* For New York State web site navigation refer to (NYDOT APL Instructions) at ***www.dot.ny.gov/index?nd=nysdot*** . (See Item 420 on the OA Schedule.)

7. Concrete Mix Designs:
On the APL website there is a folder listing concrete mix designs that have been pre-approved. When a concrete mix is placed on the APL, it meets the most current CDOT Standard Specifications; however, it may not meet a CDOT project's Special Provisions. CP 62 is the procedure for approving all concrete mixes for use on a CDOT project.

8. Warm Mix Asphalt (WMA) Mixes:
On the APL website there is a folder listing approved WMA technologies and a folder listing approved contractors for specific WMA technologies that have been pre-approved for use on CDOT Projects. Use of a WMA mix on a Project shall be approved by the Project Engineer.

9. Contractors are required to submit a Certificate of Compliance along with a copy of the Form #595 to the project engineer documenting the selection of the CDOT APL and/or QML products that they wish to include for project incorporation. (Example on Page 17.)

10. APL Quality Assurance Program:
Upon selecting the sub-category or base-category the Product ID (PID), Product Name, Manufacturer, and Comments will be displayed.

(a) By clicking on the PID / Form #595 the Pre-Approved Product Evaluation Request & Summary will be displayed. This will provide the customer with both a mini product data sheet and the information necessary for additional product analysis for specific utilization.

(b) If a product fails to perform to within minimum quality expectations contact the CDOT Product Evaluation Coordinator immediately via e-mail as listed in the APL web site.

DISCLAIMER: The Colorado Department of Transportation (CDOT) is not obligated to any manufacturer to use any of their products listed in the Approved Products List (APL). The APL simply documents that the listed products have been reviewed, tested, and evaluated against CDOT standards, and were found to be acceptable to be used in CDOT projects. Acceptance is based on product quality; however, price or availability may be the determining factor by a contractor or sub-contractor on the CDOT project.

The product shall be removed from the APL if Product Performance comments indicate that field performance is unacceptable to CDOT quality standards or if the product varies from the data as originally submitted. Additional disclaimer information can be found within the APL web site.

APL Category	APL Sub-Category	APL Base Category	Material Code
Adhesive:	Anchoring, Lateral:	Acrylic	712.10.02.00
		Cementitious	712.10.02.00
		Epoxy	712.10.02.00
		Polyester	712.10.02.00
	Anchoring, Overhead:	N/A	712.10.02.00
	Bonding:	Epoxy	712.10.01.00
Asphalt:	Asphalt Release Agent:	Truck Bed Only	401.09.01.00
		Truck & Equipment	401.09.01.00
	Binder:	PG 58-28	702.01.01.01
		PG 58-34	702.01.01.02
		PG 64-22	702.01.01.03
		PG 64-28	702.01.01.04
		PG 70-28	702.01.01.05
		PG 76-28	702.01.01.06
	Emulsion:	CSS-1	702.03.18.00
		CSS-1h	702.03.19.00
		CRS-2	702.03.15.00
		CRS-2P	702.03.21.00
		CRS-2R	702.03.23.00
		CQS-1h	702.03.20.00
		HFMS-2	702.03.08.00
		HFMS-2s	702.03.10.00
		HFMS-2P	702.03.25.00
		HFMS-2sP	702.03.26.00
		HFMS-2h	702.03.09.00
		HFRS-2P	702.03.24.00
		SS-1	702.03.11.00
		SS-1h	702.03.12.00
		ARA-1P	702.04.02.00
	Hydrated Lime:	N/A	712.03.01.00
	Roadway Patching:	Pre-Mixed [Bagged]	401.02.01.00
Bridge Structures:	Geocomposite Drain:	N/A	712.08.01.01
	Thin Bonded Overlay:	Epoxy	519.01.00.00
		Non-Epoxy	519.01.00.00
	Structural Wrapping Repair	N/A	601.09.02.00
Concrete:	Admixture:	Air Entraining	711.02.01.00
		Water-Reducing	711.02.01.00
		Retarding	711.02.01.00
		Accelerating	711.02.01.00
		Water-Reducing & Retarding	711.02.01.00
		Water-Reducing & Accelerating	711.02.01.00
		Water-Reducing, High Range	711.02.01.00

		Water-Reducing, High Range & Retard.	711.02.01.00
APL Category	APL Sub-Category	APL Base Category	Material Code
Concrete	Admixture	Extended Set-Control	711.02.01.00
		Specific Performance	711.02.01.00
		(Concrete) Corrosion Inhibitor	711.02.01.00
		Miscellaneous	711.02.01.00
	Curing Compound:	Type 1 [Clear, Wax Based]	711.01.01.00
		Type 1 [Clear, Resin Based]	711.01.01.00
		Type 2 [White Pigmented, Wax Based]	711.01.01.00
		Type 2 [White Pigmented, Resin Based]	711.01.01.00
	Cement:	Portland Cement, ASTM C 150	701.01.01.00
		Blended Cement, ASTM C 595	701.01.02.00
		Hydraulic Cement, ASTM C 1157	701.01.03.00
	Pozzolan:	Fly Ash, Class C	701.02.01.00
		Fly Ash, Class F	701.02.02.00
		High Reactivity	701.02.04.00
		Silica Fume	701.03.01.00
Concrete:	Fiber:	Macro Fiber	709.04.02.00
		Micro Fiber	709.04.02.00
	Grout:	General Purpose [Non-Shrink]	601.02.14.00
		Post-Tensioned Cable	618.02.01.00
	Repair/Patching:	Rapid Set, Horizontal	601.09.01.00.
		Rapid Set, Vertical & Overhead	601.09.01.00
		Bonding Agent	601.09.01.00
Drainage:	Culvert Pipe:	Culvert Lining [Repair]	707.12.01.00
		Open-Cut/Direct-Bury	712.13.02.00
	Manholes & Inlets:	Manhole Riser	604.04.01.00
		Trench Drain	712.14.01.00
		Plastic Drains	712.14.01.00
Drainage	Storm Water Separator:	Regular Flow Hydrodynamic	604.04.04.01
		High Flow Hydrodynamic	604.04.04.02
Environmental:	Sound Wall:	Absorptive	607.02.02.00
		Reflective	607.02.02.00
Erosion Control:	Soil Retention Rolled:	SRB [Biodegradable Class 1]	216.02.02.00
		SRB [Photodegradable Class 1]	216.02.02.00
		SRB [Biodegradable Class 2]	216.02.02.00
		SRB [Photodegradable Class 2]	216.02.02.00
Erosion Control:	Soil Retention Rolled:	TRM [Class1]	216.02.03.00
		TRM [Class 2]	216.02.03.00
		TRM [Class 3]	216.02.03.00
		TRM [Class 4 / woven]	216.02.03.00
Erosion Control:	Soil Retention Rolled:	Biodegradable Stakes	216.02.06.00
Erosion Control:	Hydraulic Applied Mulch:	Bonded Fiber Matrix	213.03.11.00
		Spray-On Mulch Blankets [Type 1]	213.03.06.00
		Spray-On Mulch Blankets [Type 2]	213.03.06.00
Erosion Control:	Ditch Control:	Silt Berm	208.02.02.00
Erosion Control:	Herbicide:	Selective Pre-emergent	
Applic. 217.02.01.00		Construction Inlet Protection:	Storm Drain
Inlet Protection 208.02.08.01			
		Selective Contact Application	217.02.01.00
Sediment/Pollution Ctrl:	Construction Inlet Protect.:	Storm Drain Inlet Protect. (Type 1)	208.02.08.01
		Storm Drain Inlet Protect. (Type 2)	208.02.08.01
		Storm Drain Inlet Protect. (Type 3)	208.02.08.01
Sediment/Pollution Ctrl:	Construction Dewatering:	Dewatering Filter Bag	208.02.18.00
Sediment/Pollution Ctrl:	Temporary Slope Drain:	Flexible Pipe	208.02.06.00
		Manufactured Channel Liner	208.02.06.00

Sediment/Pollution Ctrl:	Concrete Washout Structure:	Pre-Fabricated [Above Ground]	208.02.14.00
Sediment/Pollution Ctrl:	Vehicle Tracking Control:	Pre-Fabricated	208.02.15.01

APL Category	APL Sub-Category	APL Base Category	Material Code
Paint / Coating:	Anti-Graffiti:	N/A	708.02.01.00
	Concrete Corrosion Inhibitor:	N/A	708.08.01.00
	Epoxy Coating:	N/A	708.03.03.00
	Structural Concrete Coating:	N/A	708.08.01.00
	Structural Steel Paint:	N/A	708.03.02.00
	Wire Coating:	N/A	
Pedestrian Safety:	ADA Truncated Dome:	Embedded	608.02.03.00
		Retrofit	608.02.03.00
	Joint System	N/A	705.01.03.00
Right-of-Way Structure:	Mailbox Support System:	N/A	210.13.01,00
	Utility Enclosure:	N/A	604.04.02.00
	Fence, Non-Standard Coating	N/A	710.03.01.00
	Pole Base Hardware:	N/A	713.05.01.00
Roadway Safety:	Cable Barrier:	NCHRP 350 TL-3	606.02.06.00
		NCHRP 350 TL-4	606.02.06.00
	Guardrail W-Beam:	Guardrail End Treatment	606.02.03.00
		Guardrail End Treat., Spec. App.	606.02.03.00
		Guardrail Synthetic Blockout	606.02.04.00
	Crash Cushion:	Sand Barrel Array	614.07.02.00
		Guardrail Median Terminal	606.02.02.00
		Barrier End Treatment (Terminal)	606.02.02.00
		Impact Attenuator, Std, Perm.	614.07.02.00
		Impact Attenuator, Wide, Perm.	614.07.02.00
		Impact Attenuator, Lo-Maint, Perm.	614.07.02.00
		Impact Attenuator, Spec-App, Perm.	614.07.02.00
Roadway Safety:	Railing	Pedestrian & Bicycle	514.05.01.00
		Vehicle	606.02.05.00
Sealant [Joint & Crack]:	Asphaltic Plug Joint:	N/A	518.03.01.00
	Hot Poured, Joint/Crack:	ASTM D 6690, Type II	702.06.01.00
		ASTM D 6690, Type IV	702.06.02.00
		ASTM D 5078	702.06.03.00
	Mastic:	Under Development	
Sealant [Joint & Crack]:	Silicone, Joint:	Non-Sag	705.01.01.00
		Self-Leveling	705.01.01.00
	Pre-Formed Joint Filler:	N/A	705.01.02.00
	Loop Detector Slot:	One Component	705.01.01.00
		Two Component	705.01.01.00
Soil / Geotechnical:	Stabilization:	Chemical, Liquid	308.03.02.01
	Void Elimination:	Polyurethane Foam, Hi Density	308.03.02.01
Traffic Control:	Portable Changeable Message:	Trailer Mount	630.03.01.00
		Vehicle Mount	630.03.01.00
	Arrow Board:	Type A	630.03.01.00
		Type B	630.03.01.00
		Type C	630.03.01.00
		Type D	630.03.01.00
	Speed Notification:	Radar/Message Trailer	630.03.01.00
		Speed Display Trailer	630.03.01.00

APL Category	APL Sub-Category	APL Base Category	Material Code
		Speed Display Device	630.03.01.00
	Traffic Control Enhancement:	AFAD	630.04.01.00
		Flashing Beacon	614.06.01.00
		Warning Light	630.08.02.00
		Raised Island, Temporary	630.08.02.00
		Rumble Strip, Temporary	630.08.02.00
		Glare Screen	630.08.01.00
	Channelizing Device:	Cone	630.05.01.00
		Tubular Marker	630.05.02.00
		Vertical Panel	630.06.01.00
		Drum	630.06.02.00
		Barricade, Type 1	630.06.02.00
		Barricade, Type 2	630.06.02.00
		Barricade, Type 3	630.06.02.00
	Channelizing Device:	Direction Indicator Barricade	630.02.02.00
		Longitudinal Channelizing Device	630.06.04.00
		Opposing Traffic Lane Divider	630.06.03.00
	Delineator:	Flexible Post	612.02.02.00
		Flexible, Multiple Hit Post	612.02.02.00
		Guardrail Mount	612.02.02.00
	Reflective Element:	Barrier (Solid Wall) Marker	612.02.04.00
		Guardrail & Post Marker	612.02.04.00
		Delineator Post Marker	612.02.04.00
		Linear Reflector Strip	612.02.05.00
	Post Anchoring:	Mechanical System	612.05.01.00
		Polyurethane Foam, Backfill	614.02.03.00
	Traffic Barrier, Temporary:	Barrier, Non-Concrete	630.07.01.00
		Barrier Gate	630.07.01.00
	Crash Cushion, Temporary:	Impact Attenuator, Temporary	630.08.04.00
		Truck Mounted Attenuator (TMA)	630.08.03.00
		Trailer Mounted Attenuator	630.08.03.00
Traffic Control:	Sign Stand:	N/A	630.02.01.00
Traffic Control:	Pave. Marking Material:	Preformed Plastic Tape, Type I, Perm.	713.13.01.00
		Preformed Plastic Tape, Type II, Perm.	713.13.01.00
		Preformed Plastic Tape, Type III Perm.	713.13.01.00
		Thermoplastic, Hot Applied	713.12.01.00
		Thermoplastic, Preformed, Preheat	713.14.01.00
		Thermoplastic, Preformed, No-Preheat	713.14.01.00
		Epoxy Paint, Standard	713.17.01.01
		Epoxy Paint, Modified	713.17.01.02
		Polyurea	713.17.02.00
		Methyl Methacrylate	713.19.01.00
		Recessed Pavement Marker	713.18.02.00
		Raised Flexible Marker (Temp.)	713.18.01.00
		Temp. / Construction, Tape	713.16.01.00
		Temp. / Construction, Paint	713.16.02.00
Traffic Control:	Sign Sheeting:	ASTM D 4956, Type IV	713.04.01.00
		ASTM D 4956, Type V	713.04.01.00
		ASTM D 4956, Type VI	713.04.01.00
		ASTM D 4956, Type VI	713.04.01.00
		[Roll-up & Cone Collar]	713.04.01.00
		ASTM D 4956, Type VIII	713.04.01.00
		ASTM D 4956, Type VIII, Fluorescent	713.04.01.00
		ASTM D 4956, Type IX	713.04.01.00
		ASTM D 4956, Type IX, Fluorescent	713.04.01.00
		ASTM D 4956, Type XI	713.04.01.00
		ASTM D 4956, Type XI, Fluorescent	713.04.01.00

		Films / Miscellaneous	713.04.01.00
Waterproofing:	Concrete Sealer:	Alkyl-alkoxy Silane	515.03.01.00
		Non-Alkyl-alkoxy Silane	515.03.01.00
		Penetrating Epoxy	515.03.01.00
		Micro-Subsurface Repair	515.03.01.00
	Elastomeric Membrane:	Single Component, Hot Applied	705.09.01.00
		Non-Asphaltic	705.08.01.00

Kryptonite Construction Inc.

13369 W. Rocky Rd. Smallville, Colorado 91130
Phone 999-123-4567

Attn: Project Engineer

Date: July 10, 2014

Re: CDOT Contract ID: 53124

Re: CDOT Project No. CC 00-0000-00

Subject: Buy America Certification

Kryptonite Construction hereby certifies that the materials and quantities represented below, to be incorporated into the project, meet the contract Buy America requirements. We also certify that the Buy America paperwork and certifications required by Section 106.11 are on file at the project.

1.) 550 LF of 24" culvert pipe for bid item 603-01180

Respectfully,

Clark Kent
Construction Manager
Kryptonite Construction Inc.

EXAMPLE
(Per requirements of Subsection 4.1)
(Original Signatures Required, No Facsimiles Accepted)

Note 1: The Buy America Certification is to always be received by the Project Engineer prior to the steel or iron being incorporated into the project.
Note 2: The delivery date and/or the incorporation date may be included in the letter.

Kryptonite Construction Inc.

Summary of Buy America Certifications Received for Installed Steel / Iron Products

CDOT Project No.: CC000-000-00
CDOT Contract ID: 53124
Summary for the Period Ending: October 2014

	Item	Item Description	Quantity Delivered to Project	Unit	Delivered Cost*	Delivery Date	Installed Quanity	Unit	Installation Month	BUY AMERICA CERTIFICATION Date	BUY AMERICA CERTIFICATION Quantity
	603-01180	24" culvert pipe	550	LF		11-Jul-14	300	LF	Aug-14	10-Jul-14	550 LF
							250	LF	Oct-14	10-Jul-14	550 LF
Total	603-01180	24" culvert pipe	550	LF			550	LF			

Prepared by:_____ Title: _____ Date: _____

* If there is any foreign steel or iron permanently incorporated into the project the Contractor shall provide documentation of the project delivered cost of that foreign steel or iron.

EXAMPLE

Suggested format for the reconciliation of the Buy America Certification quantities with Installed Quantities. The Contractor shall submit this summary to the Project Engineer.

Subsection 4.1.G "The Contractor shall maintain a document summarizing the date and quantity of the material utilizing CDOT Item Number(s) and Item Description(s) delivered to the project, along with the quantity of material installed during the month."

CLARIFICATION: This summary example indicates that the Period Ended in October. The Buy America Certification date is from July 10th and the Delivery Date is from July 11th. This example document summarizes the quantity delivered along with the quantity installed.

Kryptonite Construction Inc.

13369 W. Rocky Rd. Smallville, Colorado 91130
Phone 999-123-4567

Attn: Project Engineer

Date: November 28, 2014

Re: CDOT Contract ID: 53124

Re: CDOT Project No. CC 00-0000-00

Subject: Buy America Exception for Foreign Steel

Kryptonite Construction Inc. hereby certifies that throughout the entirety of the above referenced project there was one acquisition of steel / iron from a non-American source. The Minor Exception documentation is on file at the project's Contractor's trailer as required by Section 106.11 of the contract.

_____ No Exception

__X__ Minor Exceptions: Value less than 1/10 of 1% of the total contract cost or $ 2,500.00 whichever is greater. Documentation is in our Project Files.

1.) 16 panels of ADA Truncated Domes which were imported from China were incorporated into the project. The total contract cost to date of imported steel or iron is $1,831.66.

Respectfully,

_____
Clark Kent
Construction Manager
Kryptonite Construction Inc.

EXAMPLE
(Per requirements of Subsection 4.1)
(Original Signatures Required, No Facsimiles Accepted)

American Glass Bead Inc.
Desert Ray, Tx. 76660
Phone: (254)562-2541
Fax: (254)562-2542
www.agbi.com

CERTIFIED TEST REPORT

Colorado Department of Transportation (CDOT) project number: MTCE 03-022
Name of Product: AASHTO M 247 Type 1 Colorado Spec Glass Beads
*Product Code: AGBI- 0123
Product Batch Number: 021805
*Product date of manufacturing: Feb. 18, 2005
*Quantity Shipped: 44000 Pounds
* Date of Shipment: TBA
Laboratory Information:
*AGBI Inc.: HWY 40 & FCR 145
*Testing Date: 2/18/05
* Samples Tested: Samples are from Batch # 021805
AASHTO Designation M 247
*AASHTO M 247 Type 1 Colorado Spec
Test Results: Gradation (ASTM Standard D 1214)

Sieve Designation	Specification for AASHTO M 247 Mass Percent Passing (Type 1)	Test Result
No. 20 (0.850 mm)	100	100
No. 30 (0.600 mm)	75-95	86.9
No. 40 (0.425 mm)	-	-
No. 50 (0.300 mm)	15-35	24.2
No. 80 (0.180 mm)	-	-
No. 100 (0.150 mm)	0-5	.7

AASHTO M 247 Type 1
Test Results: Other Properties

Element / Method	Specification for AASHTO M 247 Specification Limit	Test Result
Roundness/ASTM D 1155	70% min	71.4%
Crushing Resistance ASTM D 1213	Retained 0.425-mm (No. 40) sieve 133N (30 lbs.) min.	Passing
Refractive Index (Ref: TTB1325C Section 4.3.3)	1.50 min	1.52
Moisture Resistance	Non-Moisture absorption & Free flowing	Passing
Flotation	90% of all beads shall float in xylene	n/a

Certification of Material: The referenced material meets or complies with the AASHTO M 247 Type 1 Colorado Specification.

Billy Gibbons — 18 Feb, 2005

Billy Gibbons / Quality Control — Date

EXAMPLE
[Per requirements of Section 7] (Original Signatures Required, Legible copy Accepted)

I hereby certify under penalty of perjury that the material listed in this Certified Test Report represents _____ (quantity and units) of pay item _____ _____ (pay item # and description) that will be installed in conformance with the plans and specifications on Project No. _____.

Contractor — Date

North-By-Northwest, North-By-Northwest, Inc.
9876 S. Eva-Marie Blvd.
Grant, South Dakota 54321
Phone 999-123-4567

Certificate of Compliance

Product Name: Universal Bridge Deck Expansion Joint
Model:.UBDEJ-101
Lot: 135-02

Description: Pre-formed Silicone gland, that can be bonded directly to an Elastomeric concrete joint interface with a single component silicone-locking adhesive.

Material Testing Specifications:

Property	Test Method	Mean Value
Durometer (Shore A)	ASTM D 2240	55
Tensile (psi)	ASTM D 412	650 psi
Elongation (%)	ASTM D 412	382 %
Tear (die B ppi)	ASTM D 624	88 ppi
Compression Set At 350°F 22 hrs.	ASTM D 395	30 %
Operating Temperature Range		-60° F to 450° F
Specific Gravity		1.51

State Specification Reference:
Colorado DOT Standard Specifications for Road and Bridge Construction, Section 412.13 (c). Project plans as required.

CDOT Project Number NH 0507-123

The above referenced tests were performed within our laboratory on March 14th 2002. All tests passed and the minimum required values were exceeded. Applicable laboratory test reports are available upon your request.

North-By-Northwest, Inc.

John Doe
John Doe
Manager, Quality Assurance

Date: 22 June 2002

I hereby certify under penalty of perjury that the material listed in this Certificate of Compliance represents _____ (quantity and units) of pay item _____ _____ (pay item # and description) that will be installed in conformance with plans and specification on Project Number _____.

_____ Contractor

_____ Date

EXAMPLE
[Per requirements of Section 7] (Original Signatures Required, Legible copy Accepted)

BlueBerry Shortcake Construction Inc.

411 N. Southland Rd. East Westville, Colorado 91130
Phone 999-123-4567

CERTIFICATE OF CONTRACTOR'S COMPLIANCE FOR APL / QML SELECTION

Date: _____

CDOT Contract ID _____

CDOT Project No.: _____

CDOT Project Location: _____

The following material was selected from the CDOT Approved Products List in accordance with the project plans, the 2011 Standard Specifications for Road and Bridge Construction, and the 2017 Field Materials Manual. Include Form #595 with this letter.

QML Part/Sub-Part: _____

APL Category: _____

APL Sub-Category: _____

APL Base Category: _____

APL Reference No.: _____

Product Name: _____

Manufacturer: _____

Date of Web Site Review & Selection: _____

BlueBerry Shortcake Construction Inc.

Veronica Dee

Veronica Dee
Construction Manager

I hereby certify under penalty of perjury that the material listed in this Certificate of Compliance represents _____ (quantity and units) of pay item _____ _____ (pay item # and description) that will be installed in conformance with plans and specification on Project Number _____ .

_____ _____
Contractor Date

EXAMPLE

(Per requirements of Subsection 7.3.d)
(Original Signatures Required, No Facsimiles Accepted)

Appendix I

Appendix- I
Permits

CITY AND COUNTY OF DENVER

Department of Public Works - Development Services

Sewer Use and Drainage Permit

Address:
Federal Blvd & 8th Ave

*Permit # **2017-SUDP-0002284***

Project Name:Federal Blvd Reconstruction (5th Ave to Howard Pl) Weir Gulch

Application Date: 06/16/2017 ***Ready Date: 06/16/2017***

Type of Work: Addition | Use: Commercial | Reduced or Exempt Fee:
Service Area Code: 04080000 | SFRE: .5 | Tap Size:

Fee Type	Fund/Org/No	Fee Amount	Transaction Number	Payment Date	Void
SAFE Fee	411600-72400-5061102-Z0000-Z0000-PZ999	$205.00	3480394	08/09/2017	
Metro Fee	412400-72400-5061102-Z0000-Z0000-PZ999	$2,110.00	3480394	08/09/2017	
WSAA Application Fee	413400-72100-5064300-Z0000-Z0000	$100.00	3480394	08/09/2017	
WSAA Application Fee	413400-72100-5064300-Z0000-Z0000	$-100.00	3480394	08/09/2017	
SAFE Fee	411600-72400-5061102-Z0000-Z0000-PZ999	$-205.00	3480394	08/09/2017	
Metro Fee	412400-72400-5061102-Z0000-Z0000-PZ999	$-2,110.00	3480394	08/09/2017	
Report to Metro:	**Total Permit Fees:**	$0.00	**Exemption or Fee Reduction:**		

Upon proper inspection and issuance of a Sewer Connection Permit and compliance with the terms and conditions of this Permit as well as those of the associated Application, authorization to connect to the sewer system is hereby granted. All Wastewater Management Division rules and regulations, criteria, standards, details, etc., shall apply as a minimum unless specifically exempted in writing. All inspection requests must be called in to Wastewater, at the (303) 446-3759 number, no later than 3:30 P.M. on the previous business day. No inspection requests will be accepted after 3:30 P.M. If work under this Permit is not properly completed, this Permit shall become void. If work under this Permit is not commenced within one year from the date of issuance or, if after partial completion, the work is discontinued for a period of one year, this Permit shall become void. Failure to comply with this Permit may result in the imposition

TYPE OF CONNECTION: None

REQUIRED INSPECTIONS FOR THIS PERMIT

See permit conditions below for more detailed information.

Inspection Type	*Inspection Status*	*Inspection Scheduled Date/Inspection Date*
As-Built Acceptance	Pending	

SEWER PERMIT CONDITIONS:

Number:	Condition:
1	No sanitary or storm sewer construction and no ground water discharge is authorized under the terms of this permit. A supplemental permit will be required to be obtained for any additional work.
2	The 30-54 inch piping and outfall as shown and approved under 2017-CIP-0000034 / PWC2009-1204 (2011-0364) must be inspected PW WMD MAINLINE Plumbing Inspection. Installation must conform to PW WMD standards regarding workmanship and materials. All work must be done by a properly licensed Contractor. Call Chris Brinker at 303-446-3712, 24 HOURS IN ADVANCE to schedule inspections.
3	The Owner, Site Developer, Contractor and/or their authorized agents shall ensure that all potential pollutants generated during demolition or construction work associated with this Project, be prevented from discharge to stormwater conveyance systems in the vicinity of this Project Site in accordance with the following:

1. The Owner, Site Developer, Contractor and/or their authorized agents shall prevent sediment, debris and all other pollutants from entering the storm sewer system during all demolition, excavation, trenching, boring, grading, or other construction operations that are part of this Project. The Owner, Site Developer, Contractor and/or their authorized agents shall be held responsible for remediation of any adverse impacts to the Municipal Separate Storm Sewer System, receiving waters, waterways, wetlands, and or other public or private properties, resulting from work done as part of this Project.
2. The Owner, Site Developer, Contractor and/or their authorized agents shall remove all sediment, mud, construction debris, or other potential pollutants that may have been discharged to or, accumulate in the flow lines storm drainage appurtenances, and public rights of ways of the City and County of Denver as a result of construction activities associated with this Project. All removals shall be conducted in a timely manner.
3. The Owner, Site Developer, Contractor and/or their authorized agents shall insure that all loads of cut and fill material imported to or exported from this site shall be properly covered to prevent loss of the material during transport on public rights of way. (Sec.49-552; Revised Municipal Code)
4. The use of rebar to anchor best management practices, other than portable toilets, is prohibited.
5. The Owner, Site Developer, Contractor and/or their authorized agents shall implement the following Best Management Practices (BMPs) on site during construction:

i. VEHICLE TRACKING CONTROL: VEHICLE TRACKING CONTROL: This BMP is required at all access points for ingress/egress from off-site impervious surfaces to construction site pervious areas that are used by vehicular traffic or construction equipment.

ii. INLET PROTECTION: This BMP is required on all existing or proposed storm sewer inlets in the vicinity of the construction site that may receive site runoff. The BMP must be appropriate to the type of storm inlet and appropriate for the ground surface at the inlet.

iii. INTERIM SITE STABILIZATION: This BMP is required to provide a measure for preventing the discharge of sediment from construction sites where overlot grading or other site disturbance has occurred. This BMP is particularly necessary on sites where construction activities/disturbance will be limited to small areas of the Project site. Acceptable BMPs include:

a) Preserving existing vegetation
b) Seeding and planting
c) Mulching
d) Mulching and seeding
e) Temporary/Permanent re-vegetation operations
f) Chemical soil stabilizer application (requires WMD approval)

iv. WASTE MANAGEMENT/CONTAINMENT: This BMP requires that all construction wastes, fuels, lubricants, chemical wastes, trash. Sanitary wastes, contaminated soils or debris shall be contained on site, protected from contact with precipitation or surface runoff, periodically removed from the construction site, and properly disposed of.

v. SPILL PREVENTION /CONTAINMENT: This BMP defines the measures proposed for preventing, controlling, or containing spills of fuel, lubricants, or other pollutants; and protecting potential pollutants from contact with precipitation or runoff.

4 vi. CHUTE WASHOUT CONTAINMENT: Water used in the cleaning of cement truck delivery chutes shall be discharged into a predefined, bermed containment area on the job site. The required containment area is to be bermed so that wash water is totally contained. Wash water discharged into the containment area shall be allowed to infiltrate or evaporate. Dried cement waste is removed from the containment area and properly disposed of.

a) The direct or indirect discharge of water containing waste cement to the storm sewer system is prohibited (Sec.56-102a, c; Revised Municipal Code, City and County of Denver).

vii. SWEEPING: This BMP requires that impervious surfaces which are adjacent to or contained within construction sites be swept on a daily basis or as needed during the day when sediment and other materials are tracked or discharged on to them. Either sweeping by hand or use of Street Sweepers is acceptable. Street sweepers using water while sweeping is preferred in order to minimize dust. Flushing off paved surfaces with water is prohibited.

viii. PERIMETER CONTROL: This BMP requires that a construction site install a perimeter control measure along the edge of the construction Site, to prevent, or filter the discharge of surface runoff from the construction site. The type of perimeter control used shall be determined based on site conditions and location. Maintenance and repair of the control measure shall occur as needed, in a timely manner.

ix. STOCK PILES: Soils that will be stockpiled for more than thirty (30) days shall be protected from wind and water erosion within fourteen (14) days of stockpile construction. Stabilization of stockpiles located within 100 feet of receiving waters, or with slopes 3 to 1 or greater shall be completed within seven (7) days following stockpile construction. Stabilization and protection of the stockpile may be accomplished by any of the following: Mulching, Temporary/Permanent Revegetation Operations, Chemical Soil Stabilizer Application (requires Denver Public Works approval), or erosion control matting/Geotextiles. If stockpiles are located within 100 feet of receiving waters, a drainageway or the site perimeter, additional sediment controls shall be required.

x. SAW CUTTING OPERATIONS: The Contractor shall protect all storm sewer facilities adjacent to any location where pavement cutting operations involving wheel cutting, saw cutting, or abrasive water jet cutting are to take place. The Contractor shall remove and properly dispose of all waste products generated by said cutting operations on a daily basis or as needed throughout the work day. The discharge of any water contaminated by waste products from cutting operations to the storm sewer system is prohibited.? (Sec.56-102a, c; Revised Municipal Code, City and County of Denver)

xi. Structural controls: Development sites that are required to provide detention and water quality

enhancement facilities for storm runoff need to install the detention facilities early in the construction build-out of the site. Projects that are using underground detention are required to install a pretreatment structure or sedimentation basins as a means of treating potentially polluted storm water prior to entering the detention structure. Use of these structures is required for entrapping sediment and construction debris during the active construction phase of the project. The narrative section of the Management Plan is also required to address operation and maintenance of the structural controls being used as an active construction BMP.
6. Erosion and sediment control BEST MANAGEMENT PRACTICES shall be maintained and kept in effective operating condition for the duration of this Project. All necessary maintenance and repair shall be completed immediately upon discovery of any deficiency or defect.

FLOODPLAIN PERMIT CONDITIONS:

Number:	Condition:
1	WORK IN THE FLOODPLAIN (No bldgs & no impacts): THIS APPROVAL IS FOR AUTHORIZATION TO WORK IN THE FLOODPLAIN ONLY OF WEIR GULCH on the FEDERAL BOULEVARD RECONSTRUCTION - 5TH AVENUE TO HOWARD PLACE.
2	FINAL FLOODPLAIN INSPECTION: All floodplain related work must be inspected and approved by the Floodplain Manager. Installation must conform to all Department of Public Works, WMD & FEMA standards regarding workmanship and materials. The work must be done by a properly licensed Contractor and the contractor must call the Floodplain Manager (Jeremy Hamer) at 720-913-0720 with valid license and permit numbers, to schedule the required inspection. All requests for inspections must be called to schedule a minimum of 2 business days in advance.
3	EC PERMIT: All construction activities associated with this permit are subject to the conditions and requirements of Construction Activities Stormwater Discharge Permit (CASDP) #2017-EC-0000082, issued for Federal Blvd 5th Ave to Howard Place. The CASDP must be obtained prior to start of any construction activity.
4	NO IMPACT PICTURES: Provide before and after pictures to confirm that no cross section modification occurred. If it is found that the channel cross sections have been modified, a FEMA Letter of Map Revision (LOMR) will be required to map the flooding impacts. Pictures must be sent to the floodplain manager, Jeremy Hamer (jeremy.hamer@denvergov.org, 720.913.0720) prior to scheduling the Final Floodplain Inspection.
5	UDFCD INSPECTION: The Urban Drainage and Flood Control District (UDFCD) may conduct site visits during project construction within or near the channel to observe construction for conformance with the approved plans and specifications. All grouted boulder installations must have a pre-grout inspection. Coordination with UDFCD Construction Manager is required 48 hours prior to any construction and ahead of any grout operations. Contact Mike Sarmento, UDFCD Construction Manager, 303-455-6277, msarmento@udfcd.org.

Standard Comments and Condition:

Conditions:

Anytime an existing domestic water tap is reactivated or increased in pipe size, or a new domestic water tap is added, a Sewer Use & Drainage permit must be obtained from Development Services.

PLEASE NOTE: The owner/developer is responsible for improvements/repairs in the right-of-way adjacent to this site. No Certificate of Occupancy will be validated by Public Works Construction until these improvements/repairs are complete. Contact the DES Construction Inspector PRIOR to starting construction. Call 303-446-3469 for the name and number of the inspector. Any work within the public right-of-way will require a Street Cut, Construction, and/or Street Occupancy Permit(s) from Public Works Permit Operations, located at 2000 W. 3rd Ave., Room 107, phone number 303-446-3759. It is the Licensed Contractor's responsibility to obtain the proper permit(s).

CITY AND COUNTY OF DENVER
Department of Public Works / Development Services
201 W Colfax Ave, Dept 202
Denver, Colorado 80202
(720) 865-2982

CONSTRUCTION ACTIVITIES STORMWATER DISCHARGE, EROSION AND SEDIMENT CONTROL PERMIT

Project Name:	**Permit Number:**
Federal Boulevard Reconstruction	2017-EC-0000082
Project Address: Federal Boulevard and adjacent streets between 7th Avenue and approximately 100ft north of Holden Place	
Site Supervisor: Name and Company (please print)	**Site Supervisor Cell Phone:**
TBD	TBD

Permittee shall install initial BMPs then schedule and pass an initial inspection prior to any site demolition clearing, grubbing, grading or excavation activity. Inspection can be arranged by contacting Wastewater Management Division at **(303) 446-3659** at least 2 business days prior to desired inspection. This permit expires if initial inspection and start of construction has not commenced within six (6) months of issuance.

Contact the Right-of-Way Services Construction Inspector PRIOR to starting construction if any activities will impact the public Right-of-Way adjacent to this site. Call 303-446-3469 for the name and number of the area inspector. Any work within the public Right-of-Way or use of the public Right-of-Way (including Staging, parking of vehicles or stockpiling of materials) will require a Street Cut, Construction, and/or Street Occupancy Permit(s) from Public Works Permit Operations, located at 2000 W. 3rd Ave., Room 107, phone number 303-446-3759. The owner/developer is responsible for improvements/repairs in the right-of-way adjacent to this site. No Certificate of Occupancy will be validated by Public Works Construction until these improvements/repairs are complete. It is the Licensed Contractor's responsibility to obtain the proper permit(s).

Failure to comply with this Permit may result in the imposition of civil penalties (up to $10,000 per day) pursuant to Denver Revised Municipal Code (DRMC) 56-107. Disputes regarding this permit shall be resolved by administrative hearing pursuant to DRMC 56-106.

Any work within the Regulatory Floodplain requires a floodplain permit. See http://www.denvergov.org/Portals/696/documents/SUDP/floodplain.pdf.

All construction activities associated with this project shall be subject to the conditions and requirements of the approved SWMP; and shall be in compliance with the Revised Municipal Code of the City and County of Denver and all applicable Department of Public Works Rules and Regulations including Chapter 10, City and County of Denver, Department of Public Works "Rules and Regulations Governing Sewerage Charges and Fees and Management of Wastewater".

Upon completion of construction and final stabilization of the construction site, the permit holder shall submit an "Inactivation Request for Construction Activities Stormwater Discharge Permit" form to the Wastewater Management Division, City and County of Denver

As the Applicant/Permittee, I hereby certify that I have read and understand the Conditions listed herein and within the CASMP.

Signature: _____ Date: 08/11/2017

Name David Huntsinger Phone # _____

Company City and County of Denver

Not Valid w/o CCD stamp
DENVER PUBLIC WORKS
Henry Debesa
08/16/2017

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

March 24, 2017

SUBJECT: Nationwide Permit 7 Verification – Corps File No. NWO-2016-02435-DEN Federal Boulevard Improvements, Denver County, CO

Mr. James Geist
City and County of Denver
201 West Colfax Ave, Dept. 506
Denver, CO 80202

Dear Mr. Geist:

Reference is made to the above-mentioned proposed project located at approximately 39.729545°N, -105.024128°W, in the City and County of Denver, Colorado. The work as described in your submittal will consist of the installation of an outfall structure in Weir Gulch. The proposed project would result in approximately 0.02 acres of permanent impacts to waters of the United States.

Based on the information provided, this office has determined that the work is authorized by the **Department of the Army Nationwide Permit (NWP 7)**, found in the January 6, 2017, Federal Register. Enclosed is a fact sheet, which fully describes this Nationwide Permit and lists the General Conditions, Section 404 Only Conditions, and Colorado Regional Conditions, which must be adhered to for this authorization to remain valid.

Although an Individual Department of the Army permit will not be required for this work, this does not eliminate the requirement that any other applicable federal, state, tribal or local permits be obtained as required. Please be advised that deviations from the original plans and specifications of this project could require additional authorization from this office.

The applicant is responsible for all work accomplished in accordance with the terms and conditions of the nationwide permit. If a contractor or other authorized representative will be accomplishing the work authorized by the nationwide permit on behalf of the applicant, it is strongly recommended that they be provided a copy of this letter and the enclosed conditions so that they are aware of the limitations of the applicable nationwide permit. Any activity which fails to comply with all the terms and conditions of the nationwide permit will be considered unauthorized and subject to appropriate enforcement action.

This verification will be valid until March 18, 2022. In compliance with General Condition 30, the enclosed "Certification of Completed Work" form (blue) must be signed and returned to this office upon completion of the authorized work and any required mitigation.

If there are any additional questions or concerns, please contact Aaron Eilers at (303) 979-4120 or by e-mail at Aaron.R.Eilers@usace.army.mil, and reference Corps File No. NWO-2016-02435-DEN.

Sincerely,

Aaron R. Eilers
Regulatory Project Manager
Denver Regulatory Office

Enclosure(s)

Nationwide Permit 7 Fact Sheet
Certification of Completed Work

Copies Furnished:

U.S. Fish and Wildlife Service
Colorado Department of Public Health and Environment
Environmental Protection Agency
Colorado Parks and Wildlife
Karin McShea, Pinyon Environmental, 9100 West Jewell Ave, Lakewood, CO 80232

Nationwide Permit 7

Outfall Structures and Associated Intake Structures

Activities related to the construction or modification of outfall structures and associated intake structures, where the effluent from the outfall is authorized, conditionally authorized, or specifically exempted by, or otherwise in compliance with regulations issued under the National Pollutant Discharge Elimination System Program (section 402 of the Clean Water Act). The construction of intake structures is not authorized by this NWP, unless they are directly associated with an authorized outfall structure.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity. (See general condition 32.)

(Authorities: Sections 10 and 404)

Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/ or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation.

(a) No activity may cause more than a minimal adverse effect on navigation.
(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.
(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements.

No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. Spawning Areas.

Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas.

Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds.

No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material.

No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. Water Supply Intakes.

No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects from Impoundments.

If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows.

To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water

management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre- construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains.

The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment.

Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls.

Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. Removal of Temporary Fills.

Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance.

Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project.

The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers.

(a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct

management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.
(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.
(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. Tribal Rights.

No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. Endangered Species.

(a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which ''may affect'' a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur.
(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. If pre- construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.
(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district engineer will determine whether the proposed activity ''may affect'' or will have ''no effect'' to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps'

determination within 45 days of receipt of a complete pre-construction notification. In cases where the non- Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have ''no effect'' on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species- specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the ''take'' of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with ''incidental take'' provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where ''take'' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word ''harm'' in the definition of ''take'' means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide Web pages at http://www.fws.gov/ or http:// www.fws.gov/ipac and http:// www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. <u>Migratory Birds and Bald and Golden Eagles.</u>

The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether ''incidental take'' permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. Historic Properties.

(a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.
(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.
(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed.
(d) For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/ THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts.

If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters.

Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.
(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.
(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation.

The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).
(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.
(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre- construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre- construction notification, the district engineer may determine on a case-by- case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.
(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult- to-replace resources (see 33 CFR 332.3(e)(3)).
(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns.
Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.
(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)).

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2- acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee- responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee- responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. <u>Safety of Impoundment Structures.</u>

To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality.

Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management.

In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions.

The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits.

The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications.

If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

> When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.
>
> _____ (Transferee) _____ (Date)

30. Compliance Certification.

Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:
(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;
(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and
(c) The signature of the permittee certifying the completion of the activity and mitigation. The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. Activities Affecting Structures or Works Built by the United States.

If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre- construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. Pre-Construction Notification.

(a) Timing. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer.

However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is ''no effect'' on listed species or ''no potential to cause effects'' on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act.

(8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the ''study river'' (see general condition 16); and

(10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) Agency Coordination:

(1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) All NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed; (iii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via email, facsimile transmission, overnight mail, or other expeditious manner) a copy of the

complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or email that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre- construction notification. The district fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre- construction notifications to expedite agency coordination.

Further Information

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.
2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.
3. NWPs do not grant any property rights or exclusive privileges.
4. NWPs do not authorize any injury to the property or rights of others.
5. NWPs do not authorize interference with any existing or proposed Federal project (see general condition 31).

2017 Regional Conditions to Nationwide Permits in the State of Colorado

Regional Conditions Applicable to All Nationwide Permits within the State of Colorado

1. Important Spawning Areas. Activities are not authorized by any nationwide permit except after case-by- case review and consultation with Colorado Parks and Wildlife (CPW) if the activities would adversely affect important spawning areas or would be conducted in these waters during trout and Kokanee spawning seasons. Bio-engineering techniques, such as native riparian shrub plantings, are required for all bank protection activities that exceed 50 linear feet

in important spawning areas. For activities located in these important spawning areas, PCN is required and consultation with CPW must be conducted in accordance with the timeframes established in GC 32 (Pre-Construction Notification). Important spawning areas are considered Gold Medal Waters in Colorado (Attachment 2).

NOTE: Pre-application consultation with the CPW, preferably on-site, is highly recommended. Providing documentation of pre-application consultation with CPW, stating that CPW has reviewed the proposed project and has no concerns, will be helpful in project evaluation by the Corps. Please visit the following state website to determine the appropriate CPW office for coordination: http://cpw.state.co.us.

2. Fens. All nationwide permits, with the exception of 3, 5, 6, 20, 27, 32, 37, and 38, are revoked for activities located in fens and wetlands adjacent to fens. PCN is required for activities proposed for authorization by Nationwide Permits. The PCN will address potential adverse effects to fen hydrology. The permittee may not begin the activity until the Corps determines the adverse environmental effects are minimal.

A fen is defined as a groundwater-fed wetland with saturated organic soil (greater than or equal to 16 inches in thickness) that is classified as a histosol in the Natural Resources Conservation Service (NRCS) Field Indicators of Hydric Soils in the United States (Version 8.0, 2016). A copy of the document can be obtained from the NRCS at http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053171.pdf .

Note: A fen may be part of a larger aquatic system (fen complex) where wetlands and other waters adjacent to the fen may provide a critical source of hydrology necessary for sustaining the fen.

3. Springs. PCN is required for all Nationwide Permits if the activities occur within 100 feet of the discharge point of a spring. The Corps will determine if the proposed project will have more than a minimal effect to the spring and may require an Individual Permit or project modification to reduce/eliminate the spring impacts. For the purposes of this regional condition, a spring is defined as any location where groundwater flow emanates from a distinct point. Springs do not include seeps or other groundwater discharge areas where there is no distinct point source.

4. Suitable Fill. A PCN is required for the use of broken concrete as fill material within the State of Colorado. Permittees must demonstrate that soft engineering methods utilizing native or non-man made materials are not practicable (with respect to cost, existing technology, and logistics), before broken concrete is allowed as suitable fill. Use of broken concrete with exposed rebar is prohibited.

ADDITIONAL INFORMATION

The following additional information relates to minimization of impacts to jurisdictional waters of the United States and compliance with the General Conditions:

1. **Permittees are reminded** that appropriate erosion and sediment controls are required in accordance with GC No. 12 in order to properly stabilize the site and prevent erosion and siltation into wetlands and other waters downstream. Streambed material or other small aggregate material placed alone for bank stabilization will not meet GC No. 12.

2. **Permittee best management practices.** In order to prevent the spread of invasive and/or nuisance species (e.g., Asian Clam, Grand Valley Asian Tapeworm, Green River Mud Snail, New Zealand Mud Snail), the permittee is strongly encouraged to clean heavy equipment prior to and after construction if the equipment was previously used in another stream, river, lake, pond or wetland within 10 days of initiating work. The following are recommended methods for preventing the spread of invasive aquatic organisms:

Remove all mud and debris from equipment (tracks, turrets, buckets, drags, teeth, etc.) and spray/soak equipment with a 1:15 solution of disinfection solution containing the following ingredients:

- Dialkyl dimethyl ammonium chloride (5-10% by weight);
- Alkyl dimethyl benzyl ammonium chloride (5-10% by weight);
- Nonyl phenol ethoxylate (5-10% by weight);
- Sodium sesquicarbonate (1-5%); and,
- Tetrasodium ethylene diaminetetraacetate (1-15%)

The equipment should be kept moist for at least 10 minutes, and rinsate should be managed as a solid waste in accordance with local, county, state, or federal regulations. Alternately, equipment, hand tools, boots and any other equipment that was previously used in a river, stream, lake, pond, or wetland prior to moving the equipment to another water body may be disinfected using the following methods:

- Spray/soak equipment with water greater than 140 degrees Fahrenheit for at least 10 minutes.
- Sanitize water suction hoses and water transportation tanks (using methods described above) and discard rinse water at an appropriately permitted disposal facility.

3. **Designated Critical Resource Waters.** Within the State of Colorado, the waters listed in **Attachment 1** are designated as Critical Resource Waters. In accordance with GC 22, the discharge of dredged or fill material is not authorized by the following nationwide permits in these waters or their adjacent wetlands: NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, A and B. In addition, in accordance with GC 32, notification to the DE is required for the use of the following nationwide permits in these waters and their adjacent wetlands: NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37 and 38.

4. **Gold Medal Waters.** Within the State of Colorado, the waters listed in **Attachment 2** are designated as Gold Medal Waters. Requirements for projects located in these waters and their adjacent wetlands are s e t forth in RC 5 above.

ATTACHMENT 1

DESIGNATED CRITICAL RESOURCE WATERS

The Colorado Water Quality Control Division designates Critical Resource Waters (Outstanding Waters) within the State of Colorado. Please note that the following list is subject to change and typically changes on an annual basis. For the most current list, or for more information on specific designations within these watersheds and their tributaries, please refer to the Colorado Water Quality Control Commission website: https://www.colorado.gov/pacific/cdphe/wqcc or Water Quality Control Division's website: https://www.colorado.gov/pacific/cdphe/clean-water-gis-maps

Animas and Florida River Basins. All tributaries to the Animas River and Florida River, including all wetlands, which are within the Weminuche Wilderness Area.

Hermosa Creek, including all tributaries, from the source to immediately below the confluence with Long Hollow, except for the East Fork of Hermosa Creek.

All lakes and reservoirs tributary to the Animas River and Florida River which are within the Weminuche Wilderness Area. This segment includes Lillie Lake, Castilleja Lake, City Reservoir, Emerald Lake, Ruby Lake, Balsam Lake, Garfield Lake, Vestal Lake, Eldorado Lake, Highland Mary Lakes, Verde Lakes, Lost Lake, and Crater Lake.

Bear Creek Basin. The main stem of Bear Creek and all tributaries, lakes, and reservoirs, including wetlands, within the Mt. Evans Wilderness Area.

Big Thompson River Basin. The main stem of the Big Thompson River, including all tributaries, lakes, reservoirs, and wetlands, located within Rocky Mountain National Park (RMNP).

Blue River Basin. North Fork of the Swan River, including all tributaries and wetlands, from the source to the confluence with the Swan River.

All tributaries to the Blue River, including wetlands within the Eagle Nest and Ptarmigan Peak Wilderness Areas.

All lakes and reservoirs within the Eagle Nest and Ptarmigan Peak Wilderness Areas.

Boulder Creek Basin. All tributaries to Boulder Creek, including lakes, reservoirs, and wetlands, located within the Indian Peaks Wilderness Area.

Cache la Poudre River Basin. All tributaries to the Cache La Poudre River, including lakes, reservoirs, and wetlands, located within RMNP and Rawah, Neota, Comanche Peak, and Cache La Poudre Wilderness Areas.

Clear Creek Basin. All tributaries to Clear Creek, including lakes, reservoirs, and wetlands, located within Mt. Evans Wilderness Area.

San Luis Valley (Closed Basin). All tributaries in the Closed Basin, including wetlands, lakes, and reservoirs, located within the La Garita Wilderness Area.

The main stem of Sand Creek, including all tributaries and wetlands, from the source to the mouth. The main stem of Medano Creek, including all tributaries and wetlands, from the source to the mouth

Colorado River Basin. The main stem of the Colorado River, including all tributaries and wetlands, located within or flowing into RMNP.

All tributaries to the Colorado River and Frasier River within RMNP and within the Never Summer, Indian Peaks, Byers, Vasquez, Eagles Nest, and Flat Top Wilderness Areas.

Main stem of Northwater Creek and Trapper Creek, including all tributaries and wetlands, from their source to the confluence with the East Fork of Parachute Creek. East Middle Fork of Parachute Creek, including all tributaries and wetlands from the source to the confluence with Middle Fork of Parachute Creek.

Battlement Creek, including all tributaries and wetlands, from its source to a point immediately downstream boundary of BLM lands.

Main stem of Rapid Creek, including all tributaries and wetlands, from the source to a point immediately below the confluence with Cottonwood Creek including Kruzen Springs.

Dolores River Basin. All tributaries to the Dolores River and West Dolores River, including all wetlands, tributaries, which are within the Lizard Head Wilderness area, main stem of Rio Lado from the source to the confluence with the Dolores River. Main stem of Spring Creek from the source to the confluence with Stoner Creek. Main stem of Little Taylor Creek from the source to the confluence with Taylor Creek.

All lakes, and reservoirs tributary to the Dolores River and West Dolores River, which are within the Lizard Head Wilderness area. This segment includes Navajo Lake.

Eagle River Basin. All tributaries to the Eagle River system, including lakes, reservoirs, and wetlands, located within the Eagle Nest and Holy Cross Wilderness Areas of the Gore Range.

Abrams Creek, including all tributaries and wetlands, from the source to the eastern boundary of the BLM lands.

Fountain Creek Basin. Severy Creek, including all tributaries, from the source to a point just upstream of where the Forest Service Road 330 crosses the stream.

Bear Creek, including all tributaries, from the source to a point upstream of GPS coordinated N3847682, W10454917 (this location is at elevation 8,200 feet above sea level at a 250 degree angle and 3,000 feet from the trailhead of the Mount Buckhorn Trail off High Drive).

Upper Gunnison River Basin. All tributaries to the Gunnison River, including and wetlands, within the La Garita, Powderhorn, West Elk, Collegiate Peaks, Maroon Bells, Fossil Ridge, or Uncompahgre Wilderness Areas.

All tributaries and wetlands from North Beaver Creek to Meyers Gulch, from the West Elk Wilderness boundary to their confluences with Blue Mesa Reservoir, Morrow Point Reservoir, or the Gunnison River, excluding Steuben Creek, North Willow Creek, and Soap Creek.

All lakes and reservoirs that are tributary to the Gunnison River and within the La Garita, Powderhorn, West Elk, Collegiate Peaks, Maroon Bells, Raggeds, Fossil Ridge, or Uncompahgre Wilderness Areas.

Lower Gunnison River Basin. All tributaries to the Smith Fork, including all wetlands, which are within the West Elk Wilderness Area.

All lakes and reservoirs tributary to the Smith Fork, and are within the West Elk Wilderness Area.

North Fork of the Gunnison River Basin. All tributaries to North Fork of the Gunnison River, including all wetlands, within the West Elk or Raggeds Wilderness Areas.

All lakes and reservoirs that are tributary to the North Fork of the Gunnison River and within the West Elk or Raggeds Wilderness areas.

Laramie River Basin. All tributaries to the Laramie River system, including lakes, reservoirs, and wetlands, located within the Rawah Wilderness Area.

Los Pinos River Basin. All tributaries to the Los Pinos River, including all wetlands, which are within the Weminuche Wilderness Area.

All lakes and reservoirs tributary to the Los Pinos River which are within the Weminuche Wilderness Area. This includes Granite Lake, Divide Lakes, Elk Lake, Flint Lakes, Moon Lake, Rock Lake, Betty Lake, Lost Lake, Hidden Lake, Vallecito Lake, Eldorado Lake, Trinity Lake, Leviathan Lake, Sunlight Lake, Hazel Lake, Columbine Lake, and Emerald Lake.

Mancos River Basin. All tributaries of the Mancos River located within Mesa Verde National Park.

North Fork of the Gunnison River Basin. All tributaries to North Fork of the Gunnison River, including lakes, reservoirs, and wetlands, located within the West Elk and Raggeds Wilderness Areas.

North Platte River Basin. All tributaries to the North Platte River and Encampment Rivers, including lakes and reservoirs.

All wetlands located within the Mount Zirkle, Never Summer, and Platte River Wilderness Areas.

Piedra River Basin. All tributaries to the Piedra River, including all wetlands, which are within the Weminuche Wilderness Area.

All lakes and reservoirs tributary to the Piedra River which are within the Weminuche Wilderness Area. This segment includes Window Lake, Monument Lake, Hossick Lake, and Williams Lakes.

Rio Grande Basin. All tributaries to the Rio Grande, including lakes, reservoirs, and wetlands, located within the Weminuche Wilderness Area.

Roaring Fork River. All tributaries of the Roaring Fork River system, including lakes and reservoirs, located within the Maroon Bells/Snowmass, Holy Cross, Raggeds, Collegiate Peaks, and Hunter/Fryingpan Wilderness Areas.

San Juan River Basin. All tributaries to the San Juan River, Rio Blanco, and Navajo River including all wetlands which are within the Weminuche Wilderness area and South San Juan Wilderness Area.

All lakes and reservoirs which are tributary to the San Juan River, Rio Blanco, and Navajo River and located within the Weminuche Wilderness Area and South San Juan Wilderness Area.

This segment includes Archuleta Lake, Spruce Lakes, Turkey Creek Lake, Fourmile Lake, Upper Fourmile Lake, Crater Lake, Quartz Lake, Fish Lake, and Opal Lake.

San Miguel River Basin. All tributaries, including wetlands, to the San Miguel River, and within the boundaries of the Lizard Head, or Mount Sneffels Wilderness Areas.

All lakes and reservoirs tributary to the San Miguel River and within the boundaries of the Lizard Head, or Mount Sneffels Wilderness Areas.

South Platte River Basin. All tributaries to the South Platte River, including lakes, reservoirs, and wetlands, located within the Lost Creek and Mt. Evans Wilderness Areas.

St. Vrain Creek Basin. All tributaries to St. Vrain Creek, including lakes, reservoirs, and wetlands, located within the Indian Peaks Wilderness Areas and RMNP.

Uncompahgre River Basin. All tributaries to the Uncompahgre River, including all wetlands, which are within the Mt. Sneffels or Uncompahgre Wilderness Areas.

All lakes and reservoirs tributary to the Uncompahgre River and within the Mt. Sneffels or Uncompahgre Wilderness Areas.

White River Basin. All tributaries to the White River, including lakes, reservoirs, and wetlands, located within the Flat Tops Wilderness Area, including Trapper's Lake.

Yampa River Basin. All tributaries to the Yampa River, including lakes, reservoirs, and wetlands, located within Zirkle, Flat Tops, and Sarvis Creek Wilderness Areas.

ATTCHMENT 2

GOLD MEDAL WATERS

The following list of important spawning areas has been defined as Gold Medal Waters by the State of Colorado. As a reminder, according to RC 5 above, PCN is required for all proposed nationwide permit activities in these waters; consultation with CPW must be conducted in accordance with the timeframes established in GC 32.

NOTE: This list of Gold Medal Waters is subject to change. For the most current list, please refer to the Colorado Parks and Wildlife (CPW) Colorado Fishing Brochure available on the CPW website (http://cpw.state.co.us/aboutus/Pages/RegulationsBrochures.aspx) Fishing Brochure or contact any CPW or Corps office in Colorado.

GOLD MEDAL LAKES:

North Delaney Butte Lake in Jackson County.

Spinney Mountain Reservoir in Park County.

Steamboat Lake in Routt County.

GOLD MEDAL STREAMS:

Animas River from Lightner Creek to Rivera Crossing Bridge.

Arkansas River from the confluence with the Lake Fork of the Arkansas, near Leadville, downstream to Parkdale at the Hwy 50 bridge crossing above the Royal Gorge.

Blue River from Dillon Reservoir Dam to Green Mountain Reservoir inlet; and From Green Mountain Reservoir dam to Colorado River confluence.

Colorado River from Fraser River to Troublesome Creek confluence. Also, the 24 mile reach from the confluence with Canyon Creek, at the mouth of Gore Canyon, downstream to the confluence of Rock Creek, near the town of McCoy.

Fryingpan River from Ruedi Reservoir dam to Roaring Fork River Confluence.

Gore Creek from Red Sandstone Creek to Eagle River confluence.

Gunnison River from the upper boundary of the Black Canyon of the Gunnison National Monument downstream to the confluence with the North Fork of the Gunnison River.

North Platte River from the Routt National Forest boundary to the Wyoming border.

Rio Grande from Farmer's Union Canal upstream to the upper boundary of Collier State Wildlife Area.

Roaring Fork River from the confluence with the Crystal River downstream to the confluence with the Colorado River.

South Platte River: The **Middle Fork** of the South Platte River downstream from U.S. Highway 285, the **South Fork** of the South Platte River downstream from the outlet at Antero Reservoir, and from the confluence of the **Middle and South Forks** of the South Platte River downstream to the inlet of Spinney Mountain Reservoir.

Certification of Completed Work

Corps File Number:_____

Name of Permittee:_____

Date of Issuance: _____

Expiration Date: _____

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

U. S. Army Corps of Engineers
Denver Regulatory Office
9307 South Wadsworth Blvd.
Littleton, Colorado 80128-6901

Phone (303) 979-4120
Fax (303) 979-0602

Please note that your permitted activity is subject to a compliance inspection by a U. S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of said permit, and required mitigation was completed in accordance with the permit conditions.[1]

_____
Signature of Permittee

[1] If your permit included wetlands monitoring and annual reports, these activities will continue after submittal of this form until you are notified by the Denver Regulatory Office that your mitigation is successful and monitoring reports are no longer required.

Standard Special Provisions

APPENDIX J

STANDARD SPECIAL PROVISIONS

FEDERAL BOULEVARD RECONSTRUCTION – 5TH Ave to HOWARD Place
CITY AND COUNTY OF DENVER MASTER PROJECT NO. 2011-PROJMSTR-0000364
COLORADO DEPARTMENT OF TRANSPORTATION
PROJECT NO. NHPP 2873-172
SUB-ACCOUNT NO. 19957

COLORADO
DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISIONS

STANDARD SPECIAL PROVISIONS

February 3, 2011

REVISION OF SECTION 106
CERTIFICATES OF COMPLIANCE AND
CERTIFIED TEST REPORTS

Section 106 of the Standard Specifications is hereby revised for this project as follows:

In subsection 106.12, delete the second paragraph and replace it with the following:

The original Certificate of Compliance shall include the Contractor's original signature as directed above. The original signature (including corporate title) on the Certificate of Compliance, under penalty of perjury, shall be of a person having legal authority to act for the manufacturer. It shall state that the product or assembly to be incorporated into the project has been sampled and passed all specified tests in conformity to the plans and specifications for this project. One legible copy of the fully signed Certificate of Compliance shall be furnished to the Engineer prior to installation of material. The original shall be provided to the Engineer before payment for the represented item will be made.

In subsection 106.13, delete the second paragraph and replace it with the following:

The Certified Test Report shall be a legible copy or an original document and shall include the Contractor's original signature as directed above. The signature (including corporate title) on the Certified Test Report, under penalty of perjury, shall be of a person having legal authority to act for the manufacturer or the independent testing laboratory. It shall state that the test results show that the product or assembly to be incorporated into the project has been sampled and passed all specified tests in conformity to the plans and specifications for this project. One legible copy or original document of the fully signed Certified Test Report shall be furnished to the Engineer prior to installation of material. Failure to comply may result in delays to the project or rejection of the materials.

May 12, 2016

REVISION OF SECTION 106
MODIFIED EPOXY PAVEMENT MARKING
ACCEPTANCE AND PAY FACTORS

Sections 106 of the Standard Specifications is hereby revised for this project as follows:

Subsection 106.03 shall include the following:

The Contractor shall take retroreflectivity readings on all modified epoxy pavement marking lines for each mile of roadway striping on the project. A test section is defined as each continuous line type (lane lines, centerlines, edge lines, channelizing lines, and others) no greater than one mile in length, which has been completed in a single day. The Contractor shall use a Contractor-furnished retroreflectometer conforming to ASTM E 1710 or AASHTO TP111. The retroreflectometer shall be calibrated, tested and operated in accordance with manufacturer recommendations. The Contractor shall take 10 retroreflectivity readings within the test section for each stripe. These 10 readings shall be taken approximately 40 feet apart, and shall be averaged to determine the retroreflectivity of that test section of striping. In cases where striping is less than 500 feet long, 10 readings shall be taken in 10 equal intervals.

The calibration for the retroreflectometer shall be verified every day, prior to the readings being taken. The retroreflectivity readings shall be taken in the presence of the Engineer no sooner than 3 days and no later than 14 days after the marking is tack free. Traffic control required for retroreflectivity readings shall be included in the cost of the work. Initial minimum retroreflectivity reading (mcd/m2/lux) in a one mile line section of pavement marking paint shall be 400 for white and 250 for yellow. The pay factor for Modified Epoxy Pavement Marking which is allowed to remain in place at a reduced price shall be according to the following table and shall be applied to the unit bid price for Item 627, Modified Epoxy Pavement Marking:

Color	**Retro-reflectivity Reading (R) in a 1-mile section (**mcd/m^2/lux**)**	**Pay Factor (Percent) for the entire 1-mile section**
White	$R \geq 400$	100
	$375 \leq R < 400$	85
	$350 \leq R < 375$	75
	$325 \leq R < 350$	60
	$300 \leq R < 325$	50
	$R < 300$	Remove and replace
Yellow	$R \geq 250$	100
	$225 \leq R < 250$	85
	$200 \leq R < 225$	75
	$175 \leq R < 200$	60
	$150 \leq R < 175$	50
	$R < 150$	Remove and replace

Prior to taking retro-reflectivity readings, the Contractor shall remove at the retro-reflectivity reading locations any excess beads placed during marking application.

REVISION OF SECTIONS 106, 627 AND 713
GLASS BEADS FOR PAVEMENT MARKING

Sections 106, 627, and 713 are hereby revised for this project as follows:

Subsection 106.11 shall include the following:

All post-consumer and industrial glass beads for pavement marking shall have been manufactured from North American glass waste streams in the United States of America. The bead manufacturer shall submit a COC in accordance with subsection 106.12 confirming that North American glass waste streams were used in the manufacture of the glass beads.

Subsection 627.06 (c) shall include the following:

Glass beads shall be applied into the thermoplastic pavement marking by means of a low pressure, gravity drop bead applicator.

In subsection 713.08, delete the first and third paragraphs and replace with the following:

713.08 Glass Beads for Pavement Marking. Glass beads for pavement marking shall conform to AASHTO M 247, except for the following:

(1) Gradation:

U.S. Mesh	Microns	% Passing	
		Epoxy and MMA	Waterborne, Low VOC and High Build
16	1180	90-100	100
18	1000	65-80	97-100
20	850		85-100
30	600	30-50	50-70
40	425		10-35
50	300	0-5	0-10
80	180		0-5

(2) Roundness: All beads shall meet a minimum of 80 percent true spheres in accordance with the Office of Federal Lands Highways FLH T520 or a computerized optical testing method.

(3) Color / Clarity: Beads shall be colorless, clear, and free of carbon residues.

(4) Refractive Index: Minimum 1.51 by oil immersion method.

(5) Air Inclusions: Less than 5 percent by visual count.

(6) Coatings: Per manufacturer's recommendation for optimum adhesion and embedment.

(7) Chemical Resistance: Beads shall be resistant to hydrochloric acid, water, calcium chloride, and sodium sulfide as tested per methods outlined in sections 4.3.6 to 4.3.9 of the TT-B Federal Spec.1325D.

(8) For Epoxy Pavement Marking, a minimum of 50 percent of the total weight shall be manufactured using a molten kiln direct melt method. For Waterborne and Low VOC Paint, a minimum of 15 percent of the total weight shall be manufactured using a molten kiln direct melt method. All molten kiln direct melt glass beads shall be above the 600 µm (#30) sieve.

(9) Glass beads used for any type of pavement marking shall not contain more than 75 parts per million (ppm) arsenic, 75 ppm antimony and 100 ppm lead, as tested in accordance with EPA methods 3052 and 6010C, or other approved testing method

REVISION OF SECTION 106
HOT MIX ASPHALT - VERIFICATION TESTING

Section 106 of the Standard Specifications are hereby revised for this project as follows:

Delete subsection 106.05 (e) and replace with the following:

(e) *Mix Verification Testing.* After the mix design has been approved and production commences, the Department will perform a minimum of three volumetric verification tests for each of the following elements to verify that the field produced Hot Mix Asphalt (HMA) conforms to the approved mix design:

(1) Air Voids
(2) Voids in Mineral Aggregate (VMA).
(3) Asphalt Content (AC).

The test frequency shall be one per day unless altered by the Engineer.

The test results will be evaluated and the Contractor shall make adjustments if required in accordance with the following:

1. Target Values. The target value for VMA will be the average of the first three volumetric field test results on project produced hot mix asphalt or the target value specified in Table 403-1 and Table 403-2 of the specifications, whichever is higher. The target value for VMA will be set no lower than 0.5 percent below the VMA target on Form 43 prior to production. The target values for the test element of air voids and AC shall be the mix design air voids and mix design AC as shown on Form 43.

2. Tolerance Limits. The tolerance limits for each test element shall be:

AC	± 0.3 percent
Air Voids	± 1.2 percent
VMA	± 1.2 percent

3. Quality Levels. Calculate an individual QL for each of the elements using the volumetric field verification test results. If the QL for VMA or AC is less than 65 or if the QL for air voids is less than 70, the production shall be halted and the Contractor shall submit a written proposal for a mix design revision to the Engineer. Production shall only commence upon receipt of written approval from the Engineer of the proposed mix design revision.

   After a new or revised mix design is approved, three additional volumetric field verification tests will be performed on asphalt produced with the new or revised mix design. The test frequency shall be one per day unless altered by the Engineer.

   If the QL for VMA or AC is less than 65 or the QL for the test element of air voids is less than 70, then production shall be halted until a new mix design has been completed in accordance with CP 52 or CP 54, a new Form 43 issued, and the Contractor demonstrates that he is capable of producing a mixture meeting the verification requirements in accordance with A or B below:

   A. The Contractor shall produce test material at a site other than a CDOT project. The Contractor shall notify the Engineer a minimum of 48 hours notice prior to the requested test. The location and time of the test are subject to the approval of the Engineer, prior to placement. Three samples will be tested for volumetric properties. If the QL for VMA or AC is equal or greater than 65 and the QL for the element of air voids is equal or greater than 70, full production may resume or;

   B. The Contractor may construct a 500 ton test strip on the project. Three samples in the last 200 tons will be tested for volumetric properties. After construction of the test section, production shall be halted until the testing is complete and element QLs are calculated. If the QL for VMA or AC is equal or greater than 65 or the QL for the element of air voids is equal or greater than 70, full production may resume. If the QL for VMA or AC is less than 65 or the QL for the element of air voids is less

than 70, the material shall be removed and replaced at no cost to the Department. The time count will continue, and any delay to the project will be considered to have been caused by the Contractor and will not be compensable.

The costs associated with mix designs shall be solely at the Contractor's expense.

If the Contractor fails to verify the new mix design in accordance with A or B, then production shall be halted until a new mix design has been completed in accordance with CP 52 or CP 54, a new Form 43 issued, and the Contractor demonstrates they are capable of producing a mixture meeting the verification requirements in accordance with A or B.

4. New or Revised Mix Design. Whenever a new or revised mix design is used and production resumes, three additional volumetric field verification tests shall be performed and the test results evaluated in accordance with the above requirements. The test frequency shall be one per day unless altered by the Engineer.

5. Field Verification Process Complete. When the field verification process described above is complete and production continues, the sample frequency will revert back to a minimum of 1/10,000 tons. The Engineer has the discretion to conduct additional verification tests at any time.

REVISION OF SECTIONS 206 AND 601
MATURITY METER AND CONCRETE
FORM AND FALSEWORK REMOVAL

Sections 206 and 601 of the Standard Specifications are hereby revised for this project as follows:

In subsection 206.03, delete the ninth paragraph and replace with the following:

Backfill material shall not be deposited against newly constructed masonry or concrete structures, until the concrete has developed a compressive strength of 0.8 f 'c, except in cases where the structures support lateral earth pressure. Concrete compressive strength for structures supporting lateral earth pressure shall conform to subsection 601.12 (o). Concrete compressive strength shall be determined by maturity meters.

In subsection 601.09, delete (h) and replace with the following:

(h) *Removal of Forms*. The forms for any portion of the structure shall not be removed until the concrete is strong enough to withstand damage when the forms are removed.

Unless specified in the plans, forms shall remain in place for members that resist dead load bending until concrete has reached a compressive strength of at least 80 percent of the required 28 day strength, 0.80f'c. Forms for columns shall remain in place until concrete has reached a compressive strength of at least 1,000 psi. Forms for sides of beams, walls or other members that do not resist dead load bending shall remain in place until concrete has reached a compressive strength of at least 500 psi.

Forms and supports for cast-in-place concrete box culverts (CBCs) shall not be removed until the concrete compressive strength exceeds 0.6 f_c' for CBCs with spans up to and including 12 feet, and 0.67 f_c' for CBCs with spans exceeding 12 feet but not larger than 20 feet. Forms for CBCs with spans larger than 20 feet shall not be removed until after all concrete has been placed in all spans and has attained a compressive strength of at least 0.80f'c.

Concrete compressive strength shall be determined by maturity meters. At the pre-pour conference, the Contractor shall submit the location where maturity meters will be placed.

The Contractor shall provide maturity meters and all necessary wires and connectors. The Contractor shall be responsible for the placement and maintenance of the maturity meter and wire. . At a minimum a maturity meter will be placed at the mid-span of beams and at support locations. Placement shall be as directed by the Engineer.

For structures with multiple maturity meters, the lowest compressive strength shall determine when the forms can be removed.

Acceptance cylinders shall not be used for determining compressive strength to remove forms.

When field operations are controlled by maturity meters, the removal of forms, supports and housing, and the discontinuance of heating and curing may begin when the concrete is found to have the required compressive strength.

Forms for median barrier, railing or curbs, may be removed at the convenience of the Contractor after the concrete has hardened.

All forms shall be removed except permanent steel bridge deck forms and forms used to support hollow abutments or hollow piers when no permanent access is available into the cells. When permanent access is provided into box girders, all interior forms and loose material shall be removed, and the inside of box girders shall be cleaned.